



# **STUDY OF THE PROBLEMS OF MINOR IRRIGATION**



**PROGRAMME EVALUATION ORGANISATION  
PLANNING COMMISSION  
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## PREFACE

The minor irrigation programme was taken up by the P.E.O. for an evaluation study in 1960-61 at the instance of the Planning Commission. The Commission wanted a study of the problems of minor irrigation, with special reference to the hindrances and difficulties in the way of its extension. The report on the study is presented in this volume.

Problems of minor irrigation have engaged the attention of a number of committees, study teams and working groups. Brief references have been made in this report to some of the findings and recommendations of the Indian Irrigation Commission (1903), the Royal Commission on Agriculture (1928), the Grow More Food Enquiry Committee (1952) and a few other bodies. Special mention may be made here also of the studies being conducted—a few completed—by the Study Team appointed by the Committee on Plan Projects. While all these efforts go to show the importance of minor irrigation as a field for study, these also placed a burden on the P.E.O. to plan its study so as not to duplicate the ones under way or recently completed.

The distinctive feature of this study is the analysis of the operation and impact of the minor irrigation programme on the basis of field data collected at different levels, block, village, cultivator households and knowledgeable farmers. The main focus of the study has been on the problems of irrigation from tanks and wells which constitute the two major categories of minor works. Problems of State tube-wells have also been studied in selected areas and discussed independently in a separate chapter in the report. An attempt has also been made to evaluate minor irrigation statistics as they are maintained in the village records.

The cooperation and help received from the officers at different levels of the Ministry of Food and Agriculture and the Ministry of Community Development and Cooperation, and of the Development, Agriculture, Irrigation and Revenue Departments of the State Governments have made this study possible and are gratefully acknowledged. The response from the cultivators and the knowledgeable farmers has been very encouraging and is thankfully recorded.

New Delhi,  
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J. P. BHATTACHARJEE,  
*Director,*  
*Programme Evaluation Organisation.*

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## INTRODUCTION

1.1 Throughout the history of India, small irrigation works have been the backbone of agriculture in most parts of the country. Over the last 100 years or so, however, the efforts of the Government in the country have largely been directed to extension of irrigation through works of the larger type and, in particular, those involving diversion of river waters for distribution through canals. Even so, the Indian Irrigation Commission (1901—03), the report of which still remains the most comprehensive and exhaustive inquiry of the position in regard to irrigation in India, gave considerable attention to the smaller irrigation works, and in particular, suggested a scheme of their classification which has been followed ever since.<sup>1</sup> The Royal Commission on Agriculture (1926—28) was probably the first body to recognize “the importance to the cultivator of the smallest storage works and of other sources of irrigation in India”. One of the findings of this Commission was that “construction, preservation and improvement of these minor works have, in the past, not received the attention from Government which that importance justifies”, and that “much could be done to promote the development of minor works”.<sup>2</sup> The position with regard to the Government’s role in minor irrigation did not apparently undergo any significant change in the ten years or so following the report of the Commission. It was only after the launching of the Grow More Food Campaign in 1942-43 that special funds and assistance began to be extended by the Government for the construction of minor irrigation works. The position changed very significantly, however, with the initiation of the First Five Year Plan and more so in the course of the Second Plan. With the two Five Year Plans behind us, it is now an appropriate time to undertake a general review and evaluation of the minor irrigation programme in the country. This is, more or less, the purpose of this Study.

### OBJECTIVES OF THE STUDY

1.2. This study of the problems of minor irrigation was undertaken at the instance of the Planning Commission. The objectives formulated for this study are :

- (i) to assess the nature, use and growth of minor irrigation works and facilities in the rural areas during the Second Plan period, and the impact of the minor irrigation programme on the cropping pattern;
- (ii) to analyse the problems of utilization and execution of the existing works and facilities;
- (iii) to examine the state of repairs and maintenance of the older works, and the problems and difficulties in this field; and
- (iv) to discuss the problems of organisation, administration and co-ordination of the minor irrigation programme with a view to finding out avenues for improvement.

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1 Government of India, Report of the Indian Irrigation Commission, (1903).

2 Government of India, Report of the Royal Commission on Agriculture (1928), pp. 338—344.

While 1959-60 has been taken as the major reference period for the field enquiry, attempts have been made, as far as possible, to collect relevant data covering the period since 1955-56. Since the available data do not throw adequate light on the problems taken up for investigation, it was decided to base this study primarily on field data to be collected for this purpose. Since minor irrigation works include a number of sources and types like tanks, wells, bunds, reservoirs and other sources, it was decided to confine the investigation in each State to the most important source/sources as far as that State is concerned. State tube-wells have also been included in the scope of this study, even though these are usually classified separately.

## METHODOLOGY

1.3. It was accordingly decided to conduct a field enquiry for the purpose of this study in all the major States of India, except Jammu and Kashmir which was left out because most of the field work had to be done during the peak period of the winter in 1960-61. From each State, one or more districts were selected according to the number of sources of minor irrigation deemed important. In selecting these districts, consideration had to be given to their representativeness in respect of problems of utilization and maintenance of the particular sources for which the districts were taken up. One district was thus selected from each of 8 States (Assam, Gujarat, Kerala, Maharashtra, Mysore, Madras, Punjab and Orissa); while 2 districts each were selected from 5 States, Andhra, Bihar, Rajasthan, U.P. and West Bengal and 3 from Madhya Pradesh. The selection of these districts was done largely in consultation with the Director of Agriculture and Chief Engineer of minor irrigation of the State Governments. A list of the districts selected in each State along with the source of irrigation under study is given in the Appendix Table C-1.

1.4. The sampling design followed at the other stages was based on a purposive restriction of the universe represented by these districts. The following areas were excluded from the districts for the purpose of sampling of the blocks—(a) non-block areas, (b) areas covered by pre-extension blocks, (c) blocks started after 1957-58. The last condition had to be waived in Chhatarpur district, Madhya Pradesh; the reason is explained in the Appendix D. The remaining blocks in each district were classified into two categories according as the percentage of irrigated area to total gross cropped area in each block was higher or lower than the average for the district. In the case of a few districts, however, non-availability of data for the gross cropped area forced us to substitute in its place the net sown area or, in one case, the geographical area. From each of these two strata for each district, one block was selected at random. A total of 42 blocks were thus selected from the 14 States. Further details of the manner of selection of the blocks as well as their location are given in the Appendix D.

1.5. The sample of villages was drawn from a list of all the villages in the block except the uninhabited villages, small villages with less than 15 cultivator households (more or less hamlets) and those without any source of minor irrigation. In Kerala, *Karas* were selected instead of the administrative villages and in West Bengal, *Mauzas*. Minor restrictions had also to be enforced in one or two other areas. From the lists so prepared for each block, three villages were selected at random, thus giving a total of 126 villages in the second stage of the sample.

1.6. For the selection of respondent households in the sample villages, a list was made of all the cultivator households, arranged in the descending order of size of cultivation holding. A cultivator household was defined as one which had engaged in the cultivation of a piece of land however small, excluding the area in its homestead. The list so prepared was divided into five equal sections; and from each section two households were selected at random, to give a total of 10 respondent households from each sample village. Besides, this random sample, it was considered desirable to have a purposive sample consisting of 6 knowledgeable persons from each sample village. A detailed procedure was laid down for the selection of the knowledgeable persons so as to include functionaries like the Sarpanch of the Panchayat, the President or Secretary of a Cooperative, a registered grower, a Gram Sahayak, a primary school teacher and a Patwari, these details are given in Appendix D. The final sample of households thus consisted of a total 1255 cultivator households in the random sub-sample and 702 knowledgeable persons in the purposive sub-sample. The number per State naturally varied according to the number of districts selected. On an average, the sample for one district included two blocks, six villages, 60 households in the random sample and between 30 and 36 persons in the purposive sample.

1.7. Data needed for the study were collected at four levels, namely, State, block, village and household. At the State and the block levels, the regional and local officers of the Organisation prepared qualitative notes on the basis of their discussions with officials along guide points supplied to them. In addition some information has been collected directly from the State Governments. At the village and household levels, detailed schedules and questionnaires were provided to the field officers and investigators for the purpose of collecting the necessary data. Copies of these schedules, questionnaires and proforma are given in the Appendix E.

1.8. There are a number of limitations arising from a study of this nature. Most of them will be referred to in appropriate places. It may, however, be noted that the districts were selected purposively and the sample in each district can by no means be considered large enough. But this was all that was possible within the short time available for the study. Besides, reliance had to be placed for some aspects of the study on the data available in the existing records (revenue and block records). This was found necessary in our attempt to estimate changes in the cropping pattern for which data for the last five years (1955-56 to 1959-60) could not be reliably obtained through canvassing at the household level. These and other limitations are, however, unavoidable and have to be accepted in field enquiries of this type. The survey data used for this study are primarily representative of the selected districts, though the data have been presented State-wise in most cases.

1.9. The scheme of this report follows the objectives of the study already stated. In order to put the problems of minor irrigation in their proper perspective, an attempt will be made to give a broad general idea of the course of development of minor irrigation over the last few decades and the problems that arose during this period. This will be followed by a general account of the approach to minor irrigation in the two Five Year Plans, and of the outlays and expenditure during this period. Against this background, the specific issues included in the frame of the study will be discussed in the remaining part of this study. The basic framework of

analysis has been derived from the policies and programmes laid down in the Second Five Year Plan by the Planning Commission and in other documents of the Government of India. Before these are taken up, it will be in order here to give a brief account of the developments in the field of minor irrigation in the last few decades.

#### HISTORICAL BACKGROUND

1.10. *Classification of the Sources of Minor Irrigation*—The classification of irrigation works by source among the minor types goes back to the Indian Irrigation Commission which laid down the basis of the present system of classification of irrigation works. The minor works originally included three categories, tanks, wells and "other sources". Wells are further classified in terms of the masonry content in their construction. Tube-wells have come to be categorized separately only in recent years. This classification is largely in terms of source or type of works rather than their expenditure content. Tanks include all works for the storage of water and all natural depressions of which the water is used for irrigation. Wells, on the other hand, relate to works for giving access to the subterranean supply or "to the waters of river, which running deep below the level of the ground have to be lifted vertically before they can be used for flow irrigation".<sup>3</sup> "Other sources" have never been clearly defined but include mainly temporary bunds for the storage of rainfall, lift irrigation from rivers, and of channels from rivers and streams which are too small to be classified as canals, etc. The irrigation statistics of the Government of India and the States have been using this classification of works by source of water (canal, tank, well, other sources) ever since it was introduced. The categorization of works as major, medium and minor is, however, slightly different and is based on the level of cost of the works, as will be discussed in the next chapter.

#### DESCRIPTION OF SOURCES OF MINOR IRRIGATION

1.11. *Wells and Tube-wells*—Of all the sources of irrigation included in the category of minor works, well is the most important in terms of acreage irrigated. There are certain advantages in well irrigation. There is, generally, less loss of water in conveyance and evaporation than from canals. The supply is closer to the user. In fact, it is in most cases a private work, owned by the user. But even when it is shared by others as in the case of larger wells or tube-wells, the problems associated with the timing of delivery or demand by the users are simpler and easier to cope with. Wells give an opportunity for growing a wider selection of crops and for a larger range of cropping plans. The types of wells in use differ according to the geological formation in the area. Ordinary percolation wells are very common in northern India, and constitute the backbone of agriculture in States like Uttar Pradesh. Common in the Deccan Peninsula are the so-called fissure wells sunk deep into the rock in order to strike a water-bearing fissure. In the dry river beds, sand filter wells are also dug. Wells are mainly of two types—kutchra or pucca wells. The demarcation line is not clear-cut and the concept varies among the States. A brief note on the concept is given in Appendix A.

1.12. *Tanks*—Tanks and embankments are next in importance. These are a special feature of the Deccan for a number of reasons. The rivers

<sup>3</sup> Report of Royal Commission on Agriculture in India, pp. 327.

of the Deccan are not snow-fed; they are solely dependent on rain water. There are many streams which become torrential during the rainy season but dry up in the remaining part of the year. Besides, the undulating character of the region together with a rocky bed makes the cost of construction of wells prohibitive. Moreover, as the hard rocks do not suck up enough water, percolation wells are not generally successful. But tanks can easily be formed by constructing dams to plug the hollow places, or across the slope of a catchment area for storage of rain water. Lastly, the scattered population of this tract favours the system of tank irrigation. Sometimes, the tanks are constructed in a series by bunding the running stretch of the same valley at several points. The surplus water escaping over the waste-weir from one tank feeds the tank lower down, and so on. Sometimes bigger tanks are constructed across a single point in valley. Both the types of tanks are found in India. The series tanks are mostly concentrated in the Telangana area in Andhra and in many of the districts of Madras. The series system has the main advantage in that the catchment of a minor tank is actually the ayacut (the commanded area) of the immediately upper tank. Stored water is used to the maximum, because the residual after irrigation which would otherwise go waste, finds its way into the lower tanks. The system has, however, serious disadvantages also. If due to excessive floods there are breaches in the embankment of any tank in the chain, the tank lower down is unable to bear the strain of the rushing waters from the above and also suffers from breaches. This may go on down the line. Tanks in Orissa and West Bengal are of the usual reservoir types.

1.13. *Other Sources*—Besides wells and tanks, there are other methods of storing and/or diverting the natural supply of water and applying the same on cultivated land, like anicuts in the South, kuhls in the hilly areas, bandharas in Gujarat, Maharashtra and Mysore, ahars and pynees in Bihar and various types of lift irrigation devices.

1.14. *Lift Arrangements*—In addition to the nature of the works or the sources of supply of water described above, the term 'minor irrigation' is used also to include different types of lift arrangements that may be fixed to these works. The efficiency and coverage of irrigation from the minor works depends, in fact, on these lift arrangements which can range from an ordinary bamboo-pole arrangement, sometimes called 'Dhenki' or 'Don' to persian wheel driven by bullocks and even to pump sets energised either by diesel or by electric power. These lift arrangements are a part of the minor irrigation works and facilities and come under the scheme for the extension of minor irrigation under the Community Development and other rural development programmes.

#### DEVELOPMENT OF MINOR IRRIGATION SINCE 1920-21

1.15. Even though the irrigation benefit from individual minor irrigation works is quantitatively very meagre in comparison to that of individual major works, the minor sources of irrigation cover a substantial part of the country. This has been so not only in recent years but also in previous decades. In fact, the course of development of irrigation in India since 1920-21—figures on somewhat of a comparable basis are available only for this period—does not show any significant change in their degree of importance in terms of coverage of areas over the last three or four decades. This would be apparent from the figures given in Table 1.1.



TABLE 1-1  
Area Irrigated by Minor Sources Since 1920-21

Year	Net total area irri- gated	Net area irrigated by different minor sources							(In lakh acres)		
		Net irrigated from all minor sources		Wells	Tanks	Private canals	Other sources				
		Net area	% of net area irrigated from all sources								
								(1)		(2)	(3)
1920-21**	489.57	288.79	59	142.42	(49)	72.36	(25)	25.65	(9)	48.36	(17)
1930-31**	496.97	275.36	55	117.45	(43)	67.65	(25)	37.16	(13)	53.10	(19)
1942-43**	557.34	292.53	52	128.40	(44)	61.01	(21)	40.56	(14)	62.56	(21)
1950-51@	515.29	338.40	.66	147.72	(44)	89.29	(26)	28.09	(8)	73.30	(22)
1951-52@	520.13	333.97	64	161.04	(48)	85.11	(26)	29.50	(9)	58.32	(17)
1952-53@	521.94	336.33	64	161.13	(48)	81.61	(24)	33.36	(10)	60.23	(18)
1953-54@	540.38	353.94	66	165.19	(47)	104.46	(29)	32.48	(9)	51.81	(15)
1954-55@	545.82	352.28	64	166.21	(47)	99.46	(28)	30.51	(9)	56.10	(16)
1955-56@	562.37	364.05	65	166.51	(46)	109.29	(30)	33.61	(9)	54.64	(15)
1956-57@	556.82	361.21	65	162.26	(45)	110.99	(31)	33.54	(9)	54.42	(15)

N.B. Figures in brackets are percentages to Col. 3.

\*\*

(i) Figures for these years relate to undivided India and are not compared with those for the later years.  
(ii) Source : Agricultural Statistics in India, Vol. 1, Directorate of Economics and Statistics, year 1922 (thirty seventh issue), 1933 (Forty seventh issue) and 1950 (Fifty sixth issue).

@ Source : Agricultural Statistics in India, Directorate of Economics & Statistics, February, 1961.

1.16. In the year 1920-21, when the irrigated area in the country was only 48.96 million acres, 59% of this area were irrigated from minor works. As a result of the development of (Government) canals in the thirties and the forties, the proportion of the area irrigated from minor works declined to 55% in 1930-31 and to 52% in 1942-43. In 1950-51, the figures rose to 66%, and remained more or less at the same level upto 1956-57, the latest year for which data are available. This sudden jump is due to the partition of the country which led to the transfer to Pakistan of areas like West Punjab and Sind with a very heavy incidence of canal irrigation. If allowance is made for this factor, it will appear that the minor sources have tended to maintain their relative importance in the last two decades.

1.17. Of the 28.88 million acres irrigated by minor works in the year 1920-21, 49% were attributed to wells, 25% to tanks and 26% to other sources. The corresponding percentages 36 years later *i.e.*, in 1956-57 were 45.31 and 24 respectively. Obviously, wells continue to remain the most important source of minor irrigation, followed by tanks. If there has been any shift in emphasis, tanks can be said to have gained relatively more ground.

#### IMPORTANCE OF MINOR IRRIGATION AMONG THE STATES

1.18. The relative importance of different sources of minor irrigation varies considerably among the different States because of the variation in the extent and time-distribution of rainfall, in the nature of the soil, in the requirement of water for the crops grown and other factors. Table 1.2 brings out the importance of the different sources of minor irrigation in the States. In the Punjab, Bombay (Maharashtra and Gujarat), Madhya Pradesh, Rajasthan and U.P., more than two-thirds, of the area under minor irrigation are served by wells. On the other hand, in the Southern States like Andhra, Madras and Mysore and also in Orissa, tanks account for 57 to about 74 per cent of the area irrigated by all the minor works put together. While the relative importance of these two sources may vary from State to State, minor irrigation covers the major portion of the irrigated areas in all the States, except the Punjab where Government canals irrigate about two-thirds of the irrigated areas.

#### EMPHASIS ON MINOR IRRIGATION—ITS GENESIS

1.19. The crucial role that minor irrigation can play in augmenting food production within a short time, was specially recognized in the Grow More Food Campaign launched in 1943. The Grow More Food Enquiry Committee (1952) was probably the first official body to highlight the role and scope of minor irrigation. The Committee observed that the scope for such irrigation existed in most States and that special efforts should be made to assist them in the execution of minor works. They recommended that "a sum of Rs. 10 crores a year should be placed at the disposal of the Food and Agriculture Ministry during the next four years for loans to States for minor irrigation works, to be repaid within 10 years." <sup>4</sup>

1.20. The Planning Commission has since its inception been stressing the importance of minor irrigation in stepping up food production in the

<sup>4</sup> Government of India, Report of the Grow More Food Enquiry Committee (1952),

TABLE 1.2  
Area Irrigated in Different States by Minor Sources (1956-57)

State	Net total irrigated area	Net irrigated from all minor sources		Net area irrigated from different minor sources			
		Net area	% of net area irrigated from all sources	Wells	Tanks	Private canals	Other sources
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Andhra Pradesh	7,068	3,954	56	793 (20)	2,916 (74)	35 (1)	210 (5)
Assam	1,533	1,355	88	—	—	721 (53)	634 (47)
Bihar	4,384	3,435	78	525 (15)	595 (17)	566 (17)	1,749 (51)
Bombay	3,616	2,992	83	2,299 (77)	520 (17)	65 (2)	108 (4)
Kerala	829	486	59	29 (6)	77 (16)	71 (15)	309 (63)
Madhya Pradesh	2,049	1,091	53	727 (66)	270 (25)	7 (1)	87 (8)
Madras	5,517	3,522	64	1,236 (35)	2,195 (62)	2 (0)	89 (3)
Mysore	1,829	1,433	78	320 (22)	809 (57)	12 (1)	292 (20)
Orissa	2,414	1,927	80	94 (5)	1,223 (63)	69 (4)	541 (28)
Punjab	7,459	2,650	36	2,465 (93)	13 (1)	143 (5)	29 (1)
Rajasthan	3,490	2,800	80	2,238 (80)	468 (17)	—	94 (3)
U.P.	11,420	7,168	63	5,412 (76)	1,040 (14)	27 (0)	689 (10)
West Bengal	3,009	2,415	80	40 (2)	963 (40)	921 (38)	491 (20)
J & K	743	603	81	7 (1)	3 (1)	569 (94)	24 (4)
Union Territories	323	290	90	41 (14)	7 (3)	146 (50)	96 (33)
TOTAL	55,682	36,121	65	16,226 (45)	11,099 (31)	3,354 (9)	5,442 (15)

Note : Figures in brackets under Cols. 5 to 8 indicate percentages to Col. 3.

Source : Agricultural Statistics in India, Directorate of Economics & Statistics, February, 1961.

country. The First Five Year Plan indicated clearly that "Small and medium irrigation works have an important part to play in developing irrigation in the country. They have many obvious advantages. They provide a large amount of dispersed employment. They involve smaller outlay and can be executed in a comparatively shorter period. Being spread over the country, they confer widespread benefit, and it is, therefore, easier to mobilize public cooperation in their construction."<sup>5</sup>

1.21. The Foodgrains Enquiry Committee (1957) again reiterated the need for greater attention to minor works for the purpose of stepping up food production. Discussing the problems of scarcity areas, the Committee observed that "while many new irrigation works have been undertaken under the two plans, it has been brought to our notice that the number of wells available for irrigation has been going down, and adequate attention is not paid to keeping the old wells in good repair. The decline in the number of wells seems to be partly due to their replacement by canals and tube-wells, and partly to lack of repair. Wells have a part to play even in the area receiving canal water, because the grower can draw upon well water at any moment he likes."<sup>6</sup> The need and urgency of the proper maintenance of small irrigation works which had formerly been kept in repair by the zamindars was emphasized and a suggestion was made that in the Second Plan the allocation for minor irrigation should be separated out into two accounts, one for repair and maintenance and the other for new projects.

1.22. To draw the attention of the State Governments to the problem of acceleration, effective utilization and proper maintenance of minor irrigation works, three Regional Minor Irrigation Conferences were convened by the Ministry of Food and Agriculture in the year 1958. In 1959, the Agricultural Production Team of the Ford Foundation recommended, among other things, "that more emphasis be placed on irrigation projects which will yield rapid returns in food production, such as tube-wells and shallow masonry wells".

#### PROBLEMS OF MINOR IRRIGATION

1.23 The problems that are usually referred to in connection with the implementation of the minor irrigation programme relate to the extension of new works, and their execution, the maintenance of the older works and the organisational and administrative issues including those of statistics and intelligence at different levels. A brief account of these problems, as they have been reported in various sources, is given below :

1.24. *Extension*—Among the difficulties in the way of extension of minor irrigation, mention may be made of the inadequacy of investigation of the possibilities and scope for new works and delays in the sanctioning of works in advance of the construction season, in the scrutiny of minor irrigation schemes and even in their execution. Too much time, it is sometimes reported, is lost in the preparation and scrutiny of the schemes at various stages by the Engineering Department. Further, even after sanction, delays reportedly occur because of inadequate delegation of financial and administrative powers to personnel in charge of works. Another difficulty arises from the lack of proper co-ordination among the different

<sup>5</sup> Planning Commission, *First Five Year Plan* (1953), Pp. 251.

<sup>6</sup> Ministry of Food and Agriculture, *Report of the Foodgrain Enquiry Committee* (1957), Pp. 129.

<sup>7</sup> Study Team of the Ford Foundation, *Report on India's Food-Crisis and steps to meet it* (1959), Pp. 5.

departments that operate in this field, namely, Revenue, Agriculture, Community Development and Irrigation or P.W.D. It is sometimes mentioned in this connection that there is overlapping of financial provisions on minor irrigation schemes as between the Agriculture and the Community Development Departments. Still another problem is that of reducing the time-lag between the completion of works and realization of the benefits particularly from large tanks, State tube-wells, etc. Being widely dispersed, these demand greater attention from the extension agencies than seems to have been given in the past. There are other problems like land acquisition and paucity of trained and experienced personnel particularly for investigational and other technical work.

1.25. *Maintenance*—Maintenance of the executed minor works is particularly important because losses due to depreciation are considerable. The capacity to irrigate from a source decreases over time because of silting and associated factors. As long as the existing works are not properly maintained, the net increase in irrigation will be smaller than the figures of the new construction would suggest. The repair of the existing works should, therefore, receive as high a priority as construction of new works. This point has been emphasized by the Grow More Food Enquiry Committee (1952), as well as by the Foodgrains Enquiry Committee (1957). Maintenance arrangements have to take care of the cyclical operations of a routine nature required to maintain the efficiency of works, as well as unforeseen ravages of nature like floods, heavy rainfall, etc. Unless these are attended to in time, the restoration of the works to their older capacity becomes not only very expensive but sometimes impossible. All the administrative and other problems mentioned above in connection with the extension of minor irrigation apply in the case of maintenance also.

1.26. Another problem that may be referred to here relates to statistics and records of minor irrigation. Many of the States do not have any organisation entrusted with the task of co-ordinating and building up an integrated and reliable record of the potential created and utilized under the minor irrigation works, their state of maintenance and needs of improvement or restoration. Whatever records are maintained do not show separately areas newly brought under irrigation, areas which previously received precarious supplies of irrigation water but have now been stabilized, and areas going out of irrigation from the older works.

## CHAPTER II

### MINOR IRRIGATION AND THE FIVE YEAR PLANS

#### EMPHASIS ON MINOR IRRIGATION IN THE PLANS

2.1. The attempt in the first chapter has been generally to emphasize the importance of minor irrigation in the country and the progressive recognition of this importance over the last three decades. It has been shown that the importance of minor works was realised and stressed as early as the late twenties, when quite a few of the underlying problems were highlighted. Unfortunately, no systematic and effective steps seem to have been taken in the next decade or two. The period of the thirties and the early forties was characterised, if anything, by a slackening of effort and neglect of these works. The Grow More Food Campaign tried in the late forties sought to improve the state of affairs, but apparently without much of success. It was only with the emergence of the First Five Year Plan that an attempt to co-ordinate and strengthen the activities in this field was initiated. The States were encouraged to devise realistic and practicable schemes for the development and improvement of minor irrigation, and to follow them up with some sense of urgency. It is against this background that an account will be given in this chapter of the efforts made in the First and the Second Plans for the development of minor irrigation, and the nature of the results achieved. The treatment will be, as far as possible, State-wise; and this is necessary in view of the differences in the nature of minor works and problems relating thereto, among the regions of the country. This account will be prefaced by an explanation of the definition and advantages of minor works, and followed by an indication of the approach adopted in the Third Plan to the minor irrigation programme.

2.2. The need for minor irrigation seems to have received increasing emphasis with the progress of the Second Five Year Plan. This is generally borne out by the findings and recommendations of some of the committees and study teams referred to in the last chapter. The reasons for this growth of emphasis can be seen in some of the basic advantages of these works. First, minor irrigation works have a comparatively short gestation period. They can be executed in a relatively short period and with comparatively small initial outlay. What is equally important is that they are supposed to yield quicker results, as use of irrigation water follows almost immediately on the completion of the works. Secondly, these works can be executed with the help of local resources and equipment and without much of specialised technical skill. Thirdly, and as a corollary, there is negligible or no need for obtaining equipment from abroad. The foreign exchange component of such works is, therefore, very little or nil. Fourthly, these works provide a large amount of dispersed employment which can be distributed among the local people. Both local employment as well as people's participation can, therefore, be counted upon for the construction of such works. Lastly, the commitment of the Government by way of expenditure is relatively small because a fairly high proportion of these works are either privately owned or owned by local groups or bodies. In short, the commitment of the Government in

regard to provision of funds and technical skill are generally much less in the case of minor irrigation works than of major ones. All of these factors assumed increasing importance with the progress of the Plans.

#### DEFINITION OF IRRIGATION WORKS

2.3. There does not seem to have been any uniform basis laid down until 1951, for the categorization of minor works. In regard to works completed in the pre-plan period the Government of India were of the view that the term should apply to works irrigating less than 4,000 acres each. In the interests of consistency and uniformity among different States, the Planning Commission has laid down a standard definition of major, medium and minor irrigation works. A project costing above Rs. 5 crore is classified as major. A medium project costs between Rs. 10 lakh and Rs. 5 crore; while a minor work/scheme is one costing less than Rs. 10 lakh.

2.4. Most of the States have adopted this standard classification; and even those that had been following a different system seem now to be falling in line. Thus, Madras and Andhra where works commanding less than 200 acres used to be classed as minor have now accepted this definition. In the interests of administrative convenience, and in the light of the existing set-up for maintenance arrangements, the minor works are further sub-classified on area basis in some of the States. In Kerala, the old irrigation works, concentrated mostly in the Travancore region, are classified as 'petty' works if they irrigate less than 5 acres. These are expected to be maintained by the people themselves. Works irrigating more than 5 acres are classified as 'medium' and are looked after by the P.W.D. The demarcation line now being considered is 200 acres; and it is intended to entrust the panchayats with the responsibility of maintaining the minor works benefiting less than 200 acres. Maintenance of works benefiting more than 200 acres, will be retained with the P.W.D. In Maharashtra, minor works are divided into two categories. For the purpose of construction and maintenance, works irrigating 250 acres and less are under the jurisdiction of the Revenue Department, those serving above 250 acres being executed and maintained by the Irrigation and Power Department. In Assam and West Bengal, the sub-division of minor works is made on the basis of the level of costs and not the area benefited. Schemes costing less than Rs. 10,000 are called *small* irrigation schemes, while those above Rs. 10,000, *minor* schemes. The former are managed by the Agriculture Department and the latter by the Embankment and Drainage Division of the P.W.D. in Assam and by the Irrigation and Waterways Department in West Bengal.

#### FIRST FIVE YEAR PLAN—TARGET, PROGRESS AND ACHIEVEMENT

2.5. A total outlay of about Rs. 85 crore was originally provided for minor irrigation schemes in the First Plan; but the amount actually spent from the funds of the Government of India during this period came to about Rs. 45.83 crore—Rs. 37.69 crore as loan and Rs. 8.14 crore as subsidy. Besides the central assistance, quite a large amount of expenditure was incurred by the States from their own budget provisions. The exact figure of this expenditure is not, however, available. Table 2.1 gives the summary figures of achievement in the First Plan under the different types of schemes.

TABLE 2.1

## Achievement under Main Heads of Minor Irrigation in the First Five Year Plan

Schemes	Approximate No. of units completed
(1)	(2)
1. Sinking of new wells and repair to old wells .. .. .	2,00,000
2. Boring and deepening of wells .. .. .	10,000
3. Installation of pump sets .. .. .	15,000
4. Installation of persian wheels and rahats .. .. .	15,000
5. Construction of tube-wells, including State, private and filter points .. .. .	9,000
6. Construction and repair of tanks .. .. .	10,000

Source: Working Group on Minor Irrigation—Third Five Year Plan—p.10.

2.6. The First Five Year Plan had provided for a target of 11.3 million acres of additional area to be benefited by minor irrigation under the Grow More Food programme. The achievement in this respect during the First Plan period fell short of the target; and the additional area actually benefited was estimated in the Review of the First Plan at about 9.5 million acres, distributed among the States as in Table 2.2.

TABLE 2.2

## Target and Achievement under Minor Irrigation in the First Plan by State

State	Additional area brought under irrigation from minor works (000 acres)	
	Target*	Achievement*
(1)	(2)	(3)
Assam .. .. .	770	867
Bihar .. .. .	2,086	1,774
Bombay .. .. .	582	344
Madhya Pradesh .. .. .	86	95
Madras } .. .. .	556	508
Andhra } .. .. .		174
Orissa .. .. .	434	135
Punjab .. .. .	243	827
Uttar Pradesh .. .. .	1,110	1,493
West Bengal .. .. .	933	1,214
Hyderabad .. .. .	330	145
Madhya Bharat .. .. .	40	64
Mysore .. .. .	169	281
PEPSU .. .. .	310	139
Rajasthan .. .. .	193	109
Saurashtra .. .. .	105	183
Travancore-Cochin .. .. .	30	147
Other Part 'C' States .. .. .	293	99
Supplementary Provision for Irrigation .. .. .	3,000(a)	831(a)
TOTAL .. .. .	11,278	9,476

SOURCE: 1. First Five Year Plan.

2. Review of the First Five Year Plan.

(a) Achievement figure relates to State tube-wells, while the target figure includes all sources covered by the additional provision.

\*Target and achievement figures are not strictly complete nor comparable for many of the States, since the State-wise break-up of irrigation from State tube-wells and supplementary provisions are not available.



These data suffer from serious limitations in respect of accuracy and reliability, as has been pointed out in the sources where these are given, that "Statistics of minor irrigation works undertaken and of areas benefited are far from satisfactory. At present there is no record of areas benefited from small works which go out of irrigation year after year, nor is there a close enough correspondence between returns of areas irrigated and of additional irrigation in successive years". These achievement figures have, therefore, to be accepted with caution and reservation. *Prima facie*, the figures show good performance in States like Punjab, Madras, Andhra, Mysore, Assam, U.P., West Bengal, M.P. and Bihar.

2.7. Under the Community Development programme a total expenditure of Rs. 8.08 crore is reported to have been incurred on minor irrigation schemes during the First Plan period. Figures of the corresponding additional area brought under irrigation are, however, not available.

2.8. The progress of minor irrigation during the First Plan period can be considered, on the whole, not unsatisfactory, even though in some of the States, these schemes had been undertaken for the first time and much time was lost in making the necessary organisational and staff arrangements. Some of the States had, however, a large number of previously surveyed and investigated schemes ready for implementation, which enabled them to attain quicker results.

#### SECOND FIVE YEAR PLAN—TARGET, PROGRESS AND ACHIEVEMENT

2.9. As against the target of 11.3 million acres in the First Five Year Plan, the target of additional area to be irrigated from minor works during the Second Five Year Plan was fixed lower at 9 million acres. For one-half of this area i.e., 4.5 million acres, the outlay originally provided was of the order of Rs. 66 crore under the agricultural (GMF) programme; and for the other half of the area the outlay was (including the provision for land reclamation) to the tune of Rs. 55 crore under the Community Development programme. As a result of the reappraisal of the Second Plan in 1958, the financial allocation for minor irrigation schemes under the agricultural programme was raised to Rs. 92.64 crore.<sup>2</sup> No change was, however, effected in the physical targets as a result of this reallocation. The break-up of the physical and financial targets by broad categories is given in Table 2.3.

TABLE 2.3

*Target of Outlay and Achievement under Minor Irrigation in the Second Plan*

Schemes	Target		
	Additional area to be served (million acres)	Outlay (Rs. in crore)	
		Original	Revised
(1)	(2)	(3)	(4)
1. Minor irrigation schemes under the Community Development and N.E.S. programme ..	4.5	55*	55*
2. Minor irrigation schemes under Grow More Food or Agricultural programme .. ..	3.7	66	92.6
3. Tube-wells under Grow More Food programme	0.8		
TOTAL ..	9.0	121	147.6

\*Including the provision for land reclamation.

1 Planning Commission, *Review of the First Five Year Plan* (1957), Pp. 91-92.

2 Planning Commission, *Appraisal and Prospects of the Second Five Year Plan* (1958).

2.10. A review of the programmes and their achievement was made in 1959-60 by the Working Group on Minor Irrigation appointed by the Ministry of Food and Agriculture in connection with the formulation of the Third Five Year Plan. The scheme-wise break-up of the likely achievement under the GMF programme in the Second Plan was roughly forecast by this Working Group as follows :

TABLE 2.4

*Forecast of Achievement under Minor Irrigation in GMF Programme in the Second Plan*

Works	Units	Additional acreage (000 acres)	Likely ex- penditure (Rs. in lakhs)
(1)	(2)	(3)	(4)
New wells .. .. .	1,20,000	600	1,800
Old wells .. .. .	40,000	80	200
Boring of wells .. .. .	20,000	100	125
Deepening of wells .. .. .	12,000	20	20
Artesian wells .. .. .	80	1.6	3.2
		801.6	2148.2
State tube-wells .. .. .	3,200	1,000	1,800
Private tube-wells .. .. .	2,500	100	125
Filter point tube-wells .. .. .	3,300	30	90
		1,130	2,015
Diesel engines .. .. .	10,000	80	250
Electric motors .. .. .	10,000	80	100
Persian wheels .. .. .	20,000	80	80
Lift irrigation from streams and rivers .. .. .	—	100	170
		340	600
Tanks .. .. .		900	1,800
Anicuts, kuhls, bandharas, dams, rahats, bundhies, ahars and pynes .. .. .		1,800	2,500
Drainage and embankments .. .. .		1,000	400
		3,700	4,700
GRAND TOTAL .. .. .		5,970 say 6 million	9,465 Say Rs. 95 crore

SOURCE: Report of the Working Group on Minor Irrigation—Third Five Year Plan.

Tanks, embankments, anicuts and bandharas have been expected to account for nearly three-fifths of the additional area likely to be brought under minor irrigation through the agricultural programme (GMF) of the Second Plan. State tube-wells and wells are only next in importance. achievement during the Second Plan might be about 6 million acres under achievement is expected to exceed the Plan target of 4.5 million acres by about 1.5 million acres.

2.11. The review by the Working Group of the progress of minor irrigation schemes both under the Agriculture and the Community Development programmes from 1956-57 to 1959-60 showed that the total

achievement during the Second Plan might be about 6 million acres under the GMF schemes including tube-wells, and the likely expenditure might rise to about Rs. 95 crore. Under the Community Development programme, however, the total expenditure was estimated to be about Rs. 40 crore, showing a shortfall of Rs. 15 crore. The physical achievement is visualized to be much smaller, and may not exceed about 3 million acres. Thus, there will be a shortfall of about 1.5 million acres on minor irrigation under the Community Development programme; but this is likely to be made up by the higher achievement in respect of the GMF schemes. The combined target of bringing additional 9 million acres under minor irrigation is thus expected to be fully realised during the Second Plan period.

2.12. The extent to which the targets of acreage have been achieved in different States during the first four years of the Second Five Year Plan is indicated in Table 2.5.

TABLE 2.5  
*Achievement under Minor Irrigation by State, 1956-57 to 1959-60*

State	Second Plan target (Lakh acres)	Achievements for the 1st 4 years (Lakh acres)	% achievement of target
(1)	(2)	(3)	(4)
Andhra Pradesh ..	4.5	4.3	95.6
Assam .. ..	12.1	8.1	66.9
Bihar .. ..	17.4	18.8	108.0
Bombay .. ..	10.3	6.1	59.2
Madhya Pradesh ..	7.8	3.4	43.6
Madras .. ..	5.0	2.3	45.1
Orissa .. ..	3.0	1.2	40.0
Punjab .. ..	2.7	4.1	151.9
Uttar Pradesh ..	12.9	19.2	148.8
West Bengal .. ..	3.9	3.1	79.5
Jammu and Kashmir ..	1.2	N.A.	N.A.
Mysore .. ..	3.2	1.3	40.6
Rajasthan .. ..	2.0	3.7	176.2
Kerala .. ..	2.9	0.9	31.0
Union Territories ..	1.1	0.5	46.7
TOTAL ..	90.0	77.0	86.5*

SOURCE: Ministry of Food and Agriculture.

\*Percentage to 88.8 lakh acres after excluding the Jammu & Kashmir figure of Plan target.

Table 2.5 gives the total of the achievements under the GMF and the Community Development programmes. The overall achievement, according to these figures, is likely to be of the order of 86%, though the figures reach as high as 176% in Rajasthan and as low as 31% in Kerala. The achievement ratio is above 70 per cent in only six States, namely, Andhra, Bihar, Punjab, U.P., West Bengal and Rajasthan. Of these six States again, Rajasthan, Punjab, U.P., and Bihar had by 1959-60, achieved and even exceeded the Plan target. Progress seems, however, to have been particularly slow in the States of Kerala, Madhya Pradesh, Madras, Orissa and Mysore, for which the achievement ratio is less than 50%. There is thus a wide variation in the achievement to target ratio among the different States.

2.13. On the financial side, the State-wise break-up of the revised Plan outlay of Rs. 92.64 crore on minor irrigation under the GMF programme and of Rs. 55 crore (inclusive of provision under land reclamation) under the Community Development programme could not be readily obtained. The corresponding expenditure figures for the first four years were however available. In the absence of the former set of figures, it was not possible to compare the performance of different States in terms of the expenditure-outlay ratio. The available figures of expenditure are not the "actuals" of the first four years of the Second Plan (1956-57 to 1959-60) but include estimates for the last one or two years. The total for all States and Union Territories works out to Rs. 72.33 crore on schemes under the GMF programme and Rs. 34.28 crore on this head under the Community Development programme.<sup>3</sup> The ratio of this expenditure (of Rs. 106.61 crore) to the revised plan outlay of Rs. 147.64 crore (Rs. 92.64 + Rs. 55 crore) works out at 72.2%; whereas the corresponding achievement-target proportion is much higher i.e. 86.5%. There is again a wide disparity between the expenditure-outlay ratio and the achievement-target proportion.

2.14. An attempt was made to find out how much of the GMF expenditure was in the form of loans and how much in the form of grants. The relevant data were available only for two years, 1956-57 and 1957-58 of the Second Five Year Plan and are presented in Table 2.6. It appears that nearly one-half of the expenditure incurred during 1956-57 was in the form of loans, against only 5 to 6% on grants. Bihar shows the highest percentage of grants, 25% in 1957-58 and 13% in 1956-57. The figure for Madras is about 14% in both the years and about the same for West Bengal in 1956-57. It may be noted that in some of the States, the figures, given in Table 2.6, of loans disbursed exceed those of total expenditure, presumably because the former include non-plan expenditure. In some other States, where this expenditure is of a high order, funds made available by the State Governments from their own sources are also included.

#### MINOR IRRIGATION AND THE COMMUNITY DEVELOPMENT PROGRAMME

2.15. The minor irrigation programme in the Community Development sector does not appear to have been receiving adequate emphasis for some time. The Srinagar Conference on Community Development, 1960, recommended that in future two-thirds of the budget provision for agriculture, minor irrigation and land improvement under the Community Development budget should be generally earmarked for the minor irrigation programme. Table 2.7 gives figures of the budget provision for minor irrigation as percentage of budget provision for 'Agriculture, Minor Irrigation and Land Improvement' for the States which supplied the relevant data.

2.16. In the States of Andhra, Bihar, U.P., Rajasthan, Orissa, Madras and Mysore, minor irrigation accounted for more than two-thirds of the provision under the agricultural heads in the Community Development budget all through the Second Plan period. In West Bengal, Kerala and Assam, however, minor irrigation accounted for a lower percentage (lower than two-thirds) of the total provision for agriculture practically all through this period. In Assam, the proportion shows a steady rise to two-thirds in 1960-61; in the other States the fluctuations have been somewhat erratic

<sup>3</sup> SOURCE: Directorate of Economics and Statistics, Ministry of Food and Agriculture

TABLE 2.6  
*Loans and Grants as Percentage of Expenditure on Minor Irrigation under  
 GMF Schemes, 1956-57 and 1957-58*

State	1956-57						1957-58				
	Total ex- pendi- ture.	Loans		Grants		Total Ex- pendi- ture.	Loans		Grants		
		Amount	% of expendi- ture.	Amount	% of expendi- ture.		Amount	% of expendi- ture.	Amount	% of expendi- ture.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	
Andhra.	..	28.30*	50.54	6.33	11.30	71	73.66	103.75	1.89	2.66	
Assam	..	00.00	00.00	1.54	2.23	33	18.33	55.55	2.79	8.45	
Bihar	..	83.26	46.00	24.20	13.37	152	91.59	60.26	37.36	24.58	
Bombay	..	73.01*	36.87	7.15	3.61	354	137.54	38.85	4.32	1.22	
M.P.	..	61.48	51.66	12.10	10.17	142	50.80	35.77	10.92	7.69	
Madras	..	61.01	88.42	9.37	13.58	60	22.31	37.18	8.44	14.07	
Orissa	..	22.26	139.13	00.00	00.00	17	28.34	166.71	0.00	0.00	
Punjab	..	18.55	16.71	0.71	0.64	139	21.86	15.73	0.13	0.09	
U.P.	..	453	242.88	53.62	1.24	291	72.62	24.96	18.33	6.30	
W. Bengal	..	25	32.09	128.36	3.75	38	23.92	62.95	2.94	7.74	
J & K	..	25	15.13	60.52	3.00	15	16.20	108.00	0.00	00.00	
Mysore	..	68	43.00*	63.24	1.06	94	81.06	86.23	7.41	7.88	
Rajasthan	..	42	6.82	16.24	00.00	65	61.62	94.80	1.71	2.63	
Kerala	..	16	11.87	74.19	6.81	36	26.73	74.25	1.83	5.08	
Union Territories	..	17	16.61	97.70	17.59	22	16.42	74.64	0.00	00.00	
TOTAL	..	1,465	784.83*	53.58	76.30	5.21	1,529	743.00	48.59	98.07	6.41

SOURCE: Directorate of Economics and Statistics, Ministry of Food and Agriculture.

\* It includes loan figure of Hyderabad State (68.56 lakh) but its contribution to Andhra, Mysore and Maharashtra to which its different parts have been amalgamated, could not be known. The figures of these States may, therefore, be read with caution.

TABLE 2.7  
*Budget Provision for Minor Irrigation as Percentage of Budget Provision for Agriculture, Minor Irrigation  
 and Land Improvement under the Community Development Programme, 1955-56 to 1960-61*

State	Budget provision for agriculture, minor irrigation and land improvement (Rs. in lakh)						Percentage budget provision for minor irrigation to that for all agricultural programmes					
	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Andhra												
Pradesh	..	N.A.	111.6	120.6	147.0	122.4	126.8		88.0	80.7	81.4	78.4
Assam	..	25.4	30.5	35.8	39.3	41.7	53.8	58.4	59.7	59.6	60.1	66.3
Bihar	..	48.6	31.2	76.4	127.4	147.2	174.4	92.0	96.6	87.6	82.9	78.2
Kerala	..	N.A.	30.2	14.8	18.2	33.0	32.2	43.1	39.2	78.9	43.8	40.7
Madras	..	80.1	76.7	64.7	59.8	85.8	99.5	89.7	85.6	96.6	88.3	78.4
Mysore*	..	N.A.	N.A.	57.7	48.1	94.7	96.6	N.A.	96.2	94.3	88.6	80.3
Orissa	..	53.0	43.3	47.8	41.5	78.5	85.1	N.A.	98.2	92.1	87.0	80.1
Punjab*	..	26.4	48.7	57.8	62.9	71.4	89.5	93.9	89.6	81.3	87.3	80.1
Rajasthan	..	68.9	71.9	67.7	121.4	65.4	85.8	91.8	93.8	88.9	84.0	85.8
Uttar Pradesh	..	144.5	108.3	121.8	202.9	253.6	314.3	94.2	90.8	84.7	82.7	83.2
W. Bengal	..	48.9	46.2	41.1	41.0	56.7	107.2	37.5	31.6	33.2	53.3	46.6

SOURCE: State Governments.

N.A.—Not available.

\*The figures of budget provision for minor irrigation include the figures of land improvement also.

For Mysore and Punjab, separate figures were not available to us for expenditure on minor irrigation which was lumped up with expenditure on land improvement. To the extent of such expenditure is on land improvement, these are over-estimates; and a comparison with the other States included in the table is distorted. Madhya Pradesh supplied some data on these items but they could not be utilized for the above table. The actual expenditure on minor irrigation in Madhya Pradesh is given below :

Year								Total expenditure (Block plus non-block areas)	Loans only
1956-57	..	..	..	..	..	..	..	82.88	3.82
1957-58	..	..	..	..	..	..	..	60.63	8.38
1958-59	..	..	..	..	..	..	..	112.38	15.00
1959-60	..	..	..	..	..	..	..	157.38	45.00
1960-61	..	..	..	..	..	..	..	243.22	56.63

SOURCE: State Government.

Except for 1957-58, yearly expenditure shows a steady rise.

2.17. More provision in the budget does not, however, ensure an adequate level of expenditure. In some States, while the allocation for the minor irrigation programme in the Community Development budget had been below the standard prescribed by the Srinagar Conference, even the smaller provision does not seem to have been fully utilized. This will be apparent from the figures of expenditure on minor irrigation expressed as 'percentage to budget provision' given below in Table 2.8.

TABLE 2.8

*Proportion of Actual Expenditure to the Community Development Budget Provision on Minor Irrigation, 1955-56 to 1960-61*

State	Percentage of expenditure to budget provision on minor irrigation					
	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Andhra .. ..	—	34.2	88.8	95.4	77.5	100.0
Bihar .. ..	82.2	60.5	102.6	122.3	97.8	100.0
Kerala .. ..	—	20.4	25.3	57.4	152.9	213.6
Madras .. ..	103.2	81.3	133.2	124.0	96.4	115.7
Mysore† .. ..	51.6	36.1	71.5	147.9	117.2	68.4@
Orissa .. ..	40.2	76.6	54.6	95.1	50.8	21.8
Punjab† .. ..	58.7	84.8	78.5	98.7	95.4	94.4
Rajasthan .. ..	63.0	84.4	95.7	97.3	105.3	—
U.P. .. ..	43.6	98.3	99.7	99.5	98.7	—
West Bengal .. ..	22.6	75.5	95.2	184.2	75.0	5.7*

SOURCE: State Governments.

\*Expenditure figures relate upto 31-12-1960.

@Expenditure upto 31-1-61. It is expected that the whole provision will be spent.

†The figures of Budget provision and expenditure for minor irrigation include those of land improvement also.

In West Bengal in all the years except 1958-59, certain amounts provided in the budget remained unspent. In Punjab, Orissa and U.P. this has been

the case, in all the years and in Rajasthan, Mysore and Kerala up to 1958-59. In the year 1958-59 and 1959-60, in three States, the amount spent was in excess of the annual provision. In Madras, this was so in all the years except 1956-57 and 1959-60. This could be possible because adjustment could be made in the block budget, to meet expenditure on this item from provision under other agricultural heads. There is also procedural flexibility allowing for the use of unspent amounts carried over. These flexibilities have been stressed, off and on.

2.18. *Cost of Extension of M.I. Works per Acre of Area Irrigated*—From the available figures, the cost of extension of minor irrigation per acre of area irrigated has been worked out for the two Plan periods as under :—

(Figures in Rs.)

Cost per acre of area irrigated	First Plan	Second Plan	
		Original	Revised @
Plan provision .. .. .	75.9	134.4	164.0
Estimated achievement .. .. .	N.A.		150.0

@1958

2.19. It appears that the cost of extension of minor irrigation has increased over the years. Figures of outlay provided in the Plans show that the cost per acre of additional area irrigated was estimated at Rs. 76 in the First Plan, as compared to Rs. 134 in the initial and Rs. 164 in the revised Second Plan provision. In the Second Plan, however, the actual cost is expected to work out to a lower figure (Rs. 150) than could be derived from the outlay as revised in 1958. The cost per acre of minor irrigation extension, as given here, is an average for the whole country. The cost figures will show considerable variation among the States. The nature, sources and problems of minor irrigation differ from State to State and even from region to region within a State. This will be apparent from the brief account given below of the minor irrigation plans and programmes of different States.

#### MINOR IRRIGATION IN THE STATE PLANS

##### *Andhra Pradesh*

2.20. Emphasis in the First Five Year Plan of Andhra Pradesh was on the repair and improvement of old tanks and supply channels. During the Second Plan, besides repair and improvement of old tanks and channels and restoration of breached tanks, pumping schemes, formation of flood tanks, lift irrigation schemes, installation of oil engines and electric motors for irrigation purposes, sinking of new wells, well-borings, tube-wells, etc. were also included.

2.21. Of about 1,372 works of repair and improvement of tanks taken up in the First Plan in the Andhra area, 1,082 were completed, irrigating 63,500 acres by the end of the Plan period. In the Telangana area, 1,329 breached tanks with an ayacut of 89,884 acres were repaired during the First Plan period. During the Second Plan, an expenditure of Rs. 804.11 lakh—Rs. 417.42 lakh for Andhra and Rs. 386.69 lakh for Telangana—was incurred on minor irrigation schemes. The various schemes contemplated under this Plan are expected to bring in an area of about 4.02 lakh acres under irrigation by the end of the Second Plan period.



*Bihar*

2.22. In view of the considerable potentiality for minor irrigation in Bihar, a number of minor irrigation schemes were undertaken in the State during the First Five Year Plan period, for which a total provision of Rs. 691.25 lakh was made. The actual expenditure amounted to Rs. 735.17 lakh. The names of the schemes and the total achievement during the First Plan period under these are given below :—

Schemes	No. completed/ installed
1. Rahat pumps .. .. .	3,564
2. Tube-wells .. .. .	116
3. Surface percolation wells .. .. .	16,459
4. Medium irrigation schemes .. .. .	408
5. Pump sets .. .. .	2,348
6. Open borings .. .. .	7,082
7. Minor ahars, pynes and bundhs (Agriculture and Revenue Deptt.) ..	29,546

As these schemes provided for a 50% subsidy, they proved popular.

2.23. During the Second Plan, a provision of Rs. 399.91 lakh was made under minor irrigation in the agriculture sector, against which an expenditure of Rs. 653.33 lakh was incurred up to 1959-60. Total expenditure on minor irrigation during the Second Plan has been Rs. 802.25 lakh including Rs. 12.03 lakh for unified minor irrigation agency. The progress upto 1959-60 of the various schemes undertaken during the Second Plan against the plan period target fixed for them is given below :—

Schemes	Target 1956-61	Achievement 1956-57 to 1959-60
1. Tube-wells (No.) .. .. .	75	153
2. Surface percolation wells (No. 000) .. .. .	7.5	18.22
3. Rahat pumps (No.) .. .. .	2,000	2,005
4. Open boring (No.) .. .. .	3,750	7,421
5. Medium irrigation schemes (No.) .. .. .	725	442
6. Maintenance and distribution of electric pumps and diesel pumps (No.) .. .. .	5,000	195
7. Construction of ahars, pynes and bundhs (No.) .. .. .	4,500	4,425
8. Distribution of irrigation pumps .. .. .	—	145
9. Minor irrigation and drainage schemes (000 acres) .. .. .	—	22,400

It can be seen that achievement in respect of the minor irrigation schemes is likely to exceed the target considerably. The Draft Third Five Year Plan of Bihar mentions that 16.90<sup>4</sup> lakh acres were provided with minor irrigation facilities during the First Plan period and 26.26 lakh acres during the Second Plan period.

*Gujarat*

2.24. The main sources of minor irrigation in this area are (i) wells—surface, bore, artesian and tube; (ii) lift irrigation and pumping arrangement and (iii) tanks and bandharas. During the First Five Year Plan, the emphasis was more on repairs and improvements than on creating new

<sup>4</sup> This figure, obtained from the State Government publication, does not compare with that given earlier at pages 13 and 16.

works. The following figures show the expenditure and achievement under minor irrigation, excepting tube-wells, during the First Plan period :—

Items	Units
1. Total works taken up (No.)	765
2. Works completed during the First Plan (Rs. in lakh)	619
3. Estimated cost of works when completed (Rs. in lakh)	169·83
4. Irrigation potential of completed works (Acres)	1,06,000
5. Additional area irrigated during the First Plan (Acres)	67,000
6. Expenditure incurred during the First Plan (Rs. in lakh)	351·01

It appears that in the First Plan period, the expenditure exceeded the original estimates, but the number of schemes executed and the area irrigated fell short of the target. As regards tube-wells during the First Plan, the Government envisaged a programme of constructing 400 tube-wells at an estimated cost of Rs. 215 lakh, besides 25 tube-wells allocated for construction under the Community Development programme. Actually 336 tube-wells were drilled, of which 119 were put to irrigation use, creating an irrigation potential of 25,800 acres. The area actually irrigated from them was, however, only 6,400 acres. A total expenditure of Rs. 138 lakh was incurred during the Plan period on tube-wells.

2.25. The total expenditure during the first four years of the Second Five Year Plan is reported to be Rs. 960.39 lakh under the GMF programme; year-wise figures\* are given below separately for the P.W.D., Agriculture Department and the Cooperative Department (lift irrigation).

Year	Actual expenditure (Rs. in lakh)			
	Total	P.W.D.	Agriculture Department	Cooperative Deptt. lift irrigation
1956-57	184·43	160·89	20·27	3·27
1957-58	240·79	150·67	79·45	10·67
1958-59	289·74	167·32	116·37	6·05
1959-60	245·43	75·20	159·05	11·18
<b>TOTAL</b>	<b>960·39</b>	<b>554·08</b>	<b>375·14</b>	<b>31·17</b>

In spite of this expenditure, the additional area which will be benefited is likely to be only 33,000 acres as against the irrigation potential of 132,000 acres which was expected to be created through the minor irrigation schemes in the Second Plan period. Regarding tube-wells, a programme of constructing 400 tube-wells at an estimated cost of Rs. 246.68 lakh was provided for during the Second Plan period. But on account of the necessity of having a minimum spacing of 1½ miles between any two tube-wells, it was decided to drill only 270 tube-wells under the schemes. By 1959-60, 362 tube-wells were reportedly in operation and in the first four years of the Second Plan actual expenditure on tube-wells was Rs. 111.47 lakh.

*Madhya Pradesh*

2.26. Special emphasis was laid on minor irrigation schemes under the agricultural programme of the State during the First and the Second Plan periods and concerted efforts were made to fully utilize the available provision. During the First Plan, emphasis was laid on the construction of new tanks, restoration and improvement of old works and a few lift irrigation schemes. In the Second Plan, construction and repair of wells,

\*Source : Statistical statements obtained by the Ministry of Food and Agriculture from the State Government.

installation of electric and oil pumps and persian wheels also received considerable attention in addition to tanks. Construction of tube-wells received relatively low priority.

2.27. The First Plan of the State Government included 342 schemes under minor irrigation (GMF programme) costing Rs. 685 lakh and capable of irrigating 2.46 lakh acres. Of these, 334 projects were taken up and only 214 schemes costing Rs. 373 lakh had been completed bringing under irrigation an area of 25,000 acres. In the Second Plan, as against an allocation of Rs. 371.4 lakh for minor irrigation schemes to be executed by the P.W.D. (Irrigation Branch), an amount of Rs. 241.5 lakh or 65% of the outlay was actually spent during the first 3 years of the Plan period (1956—59). Progress of the schemes executed by the Agriculture Department showed that a sum of Rs. 180.6 lakh or 43.5% of the Plan provision of Rs. 414.94 lakh was actually spent during the first 3 years. Total expenditure during the Second Plan by both the Departments had been Rs. 834.1 lakh.

#### *Maharashtra*

2.28. The following categories of works in Maharashtra are covered by minor irrigation :—

- (i) Wells—surface, bore, artesian and tube;
- (ii) Lift irrigation and pumping arrangement;
- (iii) Surface irrigation like tanks and bandharas;
- (iv) Drainage and embankment (protective).

2.29. In the First Five Year Plan of the State, 497 minor irrigation works estimated to cost Rs. 729.9 lakh were included, of which 336 works were completed by the end of the First Plan, reportedly creating an irrigation potential of 64,682 acres.

2.30. During the Second Five Year Plan, 161 works estimated to cost Rs. 595.07 lakh. The main items of works included under this programme estimated to cost Rs. 751.18 lakh have been taken up. The expenditure on the spill-over works during the First Five Year Plan period was Rs. 327.00 lakh. The expenditure on both these works during the Second Five Year Plan is placed at Rs. 992.78 lakh.

#### *Madras*

2.31. Minor irrigation has assumed special importance in the State of Madras, because very little scope is left for further large scale extension of irrigation under the river projects. The Second Five Year Plan provided for a sum of Rs. 341.66 lakh for minor irrigation schemes. As against this, the actual expenditure during the Plan period *i.e.*, up to 1960-61 has been Rs. 595.07 lakh. The main items of works included under this programme were (i) special minor irrigation works for the restoration of neglected sources of irrigation in ex-zamin areas, (ii) desilting-cum-reclamation of tanks, (iii) scheme for sinking of tube-wells and artesian wells, (iv) well subsidy scheme and (v) other schemes like filter point wells scheme, river pumping scheme and lift irrigation (hiring and hire-purchase) schemes.

#### *Mysore*

2.32. During the First Five Year Plan, a sum of Rs. 254.02 lakh was provided under minor irrigation for restoration of old tanks and construc-

5 See Footnote on p. 22.

tion of new works. As against this, an expenditure of Rs. 243.58 lakh was incurred. In addition, an outlay of Rs. 171.78 lakh was provided in the State budget. Thus, a total expenditure of about Rs. 415.36 lakh was incurred during the First Five Year Plan on minor irrigation. The achievement in physical terms was to assure irrigation to about 2.60 lakh acres of the old atchut (ayacut) area and to bring under irrigation an additional area of 16,876<sup>6</sup> acres.

2.33. During the Second Five Year Plan period, a provision of Rs. 580.50 lakh was made for minor irrigation. As against this, the amount actually spent during the Plan period (up to the end of 1960-61) was Rs. 677.01 lakh.

2.34. For the Community Development block areas, a provision of Rs. 311.59 lakh was made during the Second Five Year Plan of which a little over Rs. 291 lakh are estimated to have been utilized.

#### *Orissa*

2.35. Information obtained from the office of the Chief Engineer (Irrigation), reveals that in all, 71 minor irrigation schemes were to be taken up for execution during the First Five Year Plan period and a total allotment of Rs. 1 crore was made for them. An area of 1.71<sup>7</sup> lakh acres was to be irrigated on their completion. As against the target of 71 schemes, 50 schemes were completed at a cost of Rs. 73.6 lakh and the area benefited was about 1.17 lakh acres. Out of these, over 37,000 acres were in the block areas.

2.36. During the Second Five Year Plan an expenditure of Rs. 161.53 lakh was incurred under the GMF programme. Out of this Rs. 15.79 lakh were spent on tube-well schemes and the remaining on schemes of tanks, anicuts, bandharas etc. The progress during 1959-60, was not good, because of reported difficulties in acquiring land for the projects; the prescribed procedure for land acquisition being rather dilatory.

#### *Punjab*

2.37. During the Second Five Year Plan, an outlay of Rs. 570 lakh was made for the minor irrigation programme; the likely expenditure is estimated at Rs. 469 lakh. While there will be a shortfall in expenditure, according to the information furnished in the Draft Third Plan, the five year target will be exceeded as indicated below :—

Schemes	Target (No.)	Anticipated achievement
Sinking of percolation wells .. .. .	3,803	4,558
Sinking of tube-wells (private) .. .. .	305	505
Purchase of pump sets .. .. .	760	1,040
Construction/Repair of kuhls in hilly areas .. .. .	340	440

Further 1,182 State tube-well had been sunk by January, 1961.

#### *Rajasthan*

2.38. The main items of the minor irrigation programme in Rajasthan include construction of wells, development of village tanks, loans for pump sets and persian wheels, etc. The schemes envisaged during the First Plan numbered 244. Their cost was Rs. 193.15 lakh. These schemes were estimated to irrigate 2.51<sup>9</sup> lakh acres. But, only 184 schemes with an

6, 7, 8 and 9 See Footnote on Page 22.

irrigation potential of 1.22<sup>10</sup> lakh acres could be executed. The remaining 60 minor irrigation works with a spill-over cost of Rs. 86.53 lakh were continued in the Second Plan. Even during the Second Plan, all these schemes are not likely to be completed.

2.39. During the Second Plan, Rs. 240.80 lakh were sanctioned for 107 new minor irrigation works with an estimated potential of 78,000 acres. Besides the GMF programme, during the Second Plan the funds for minor irrigation included a sum of Rs. 276 lakh, transferred from the agriculture budget. This constituted 64% of the total agricultural budget.

The total expenditure in the Second Plan is reported to be Rs. 424.52 lakh under the GMF schemes. Their split-up is given below :—

Sl. No.	Schemes	Units	Acreage	Expenditure (Rs. in lakh)
1.	New wells .. .. .	12,618	37,854	191.02
2.	Deepening of wells .. .. .	17,105	17,105	17.48
3.	Tube-wells .. .. .	14	1,400	8.77
4.	Pump sets .. .. .	831	2,583	11.10
5.	Persian wheels .. .. .	1,732	1,732	3.53
6.	Village tanks .. .. .	558	5,580	27.06
7.	Tanks, anicuts, bandharas etc. .. .. .	N.A.	90,000	165.56
TOTAL .. .. .		—	156,254	424.52

N.A. = Not available.

On the organisation side, a survey and investigation division was set up in the Second Plan period with a provision of Rs. 13.25 lakh. Originally there was one division incharge of survey and investigation for the whole of Rajasthan. Now one unit of survey and investigation organisation under the charge of a superintending engineer with 4 survey divisions has been created. This organisation will continue during the Third Five Year Plan period for which a provision of Rs. 40 lakh at the rate of 8 lakh per year has been proposed.

#### Uttar Pradesh

2.40. Some of the minor irrigation schemes included in the First Plan were actually started earlier; about Rs. 264 lakh were spent on these schemes before the plan commenced. During the First Plan a further expenditure of Rs. 1461 lakh was incurred, bringing the total amount to Rs. 1,725 lakh. During the Second Plan period, an expenditure of Rs. 1,365 lakh was incurred on the First and Second Plan schemes. Thus, these schemes which are expected to be completed by the end of the Third Plan would cost Rs. 3,055 lakh and would have a total irrigation potential of 25.49 lakh acres by the end of the Third Plan.

2.41. The position regarding the utilization of irrigation potential in the State is given below :—

Schemes	Utilization (Lakh acres)
1. Pre-First Plan schemes	
(i) Utilization upto 1950-51 .. .. .	10.16
(ii) Utilization upto 1955-56 .. .. .	14.35
2. Second Plan scheme	
Additional utilization during Second Plan .. .. .	13.18

<sup>10</sup> See Footnote on p. 22.

2.42. *Tube-wells*.—At the commencement of the First Five Year Plan, 2,305 tube-wells existed in the State. In the First Plan period, construction of 3,151 State tube-wells was taken up for the benefit of western, central and eastern regions of the State. Of these, 2,864\* tube-wells were actually constructed upto the end of March, 1956. By the end of Second Plan, about 6,500 tube-wells were expected to be in operation.

#### *West Bengal*

2.43. Under the First Five Year Plan, over one hundred minor irrigation and drainage works were executed in West Bengal under different schemes like procurement bonus schemes, emergency irrigation and relief rehabilitation schemes, other minor irrigation works, and new minor irrigation and drainage schemes etc. A total provision of Rs. 25.86 lakh was made for these schemes, of which 19.38 lakh were actually spent until 1954-55 on the first three types of schemes. Total area benefited from all these types of schemes was 2.2<sup>11</sup> lakh acres.

2.44. In the Second Plan, a provision of Rs. 293.50 lakh was made for the minor irrigation programme, of which a sum of Rs. 227.78 lakh is likely to be spent by the end of the Second Plan period. The shortfall is mainly accounted for by the deep tube-well irrigation schemes on which work was started at a late stage. On the other schemes, progress has reportedly been satisfactory. Against the target of 3.85 lakh acres of area to be brought under irrigation by the end of the Second Plan period, the progress of schemes undertaken indicate actual achievements at nearly 3.0 lakh acres, or a shortfall of 0.85 lakh acres.

#### RECOMMENDATIONS FOR THE IMPLEMENTATION OF THE MINOR IRRIGATION PROGRAMME IN THE PLANS

2.45. The problems and difficulties generally associated with the implementation of the minor irrigation programme have been referred to in the last chapter. Many of the problems are fairly well known and have engaged the attention of the Planning Commission and the concerned Ministries of the Central Government as well as the relevant departments of some of the State Governments. A number of suggestions and recommendations have been made from time to time at meetings, conferences and seminars as well as by a few committees. Some of these have already been referred to, while some others will be discussed in their appropriate context in the later chapters. The discussion of the minor irrigation programmes in the two Five Year Plans will, however, be incomplete without some reference to the basic suggestions and recommendations that have been made by the Planning Commission. It is these recommendations that provide a part of the framework for this study.

2.46. *First Five Year Plan*.—In the report on the First Five Year Plan, the Planning Commission recommended a number of steps both for expediting the construction of new works and for the maintenance of the existing ones. In regard to the construction of new works, for which a special provision of Rs. 30 crore was made in the First Plan, the Commission recommended that "every State should carry out a systematic survey of the possibilities of undertaking such schemes, and formulate a programme of execution in an order of priority, so that their construction can be effected in a planned manner"<sup>12</sup>. The Commission also gave some thought to the

\* Source: Directorate of Economics and statistics, Ministry of Food and Agriculture.

<sup>11</sup> See Footnote on P. 22.

<sup>12</sup> *First Five Year Plan*, pp. 251.

administrative arrangements needed. Keeping in view the need for stimulating local competition for their execution, they also recommended that the undertaking of these projects should be made conditional on the availability of a certain amount of people's contribution in cash and labour. They further suggested that the State Governments should build up a corps of personnel for the implementation of these schemes.

2.47. As regards the maintenance of the works, the report on the First Plan took note of the neglect of the minor irrigation works consequent on the abolition of zamindari. The specific recommendation was that "the responsibility for their maintenance and repair should be unambiguously fixed and the beneficiaries should be required to pay water rates in proportion to the advantage derived by them".<sup>13</sup> The Commission further suggested that the management of these works should rest with the irrigation Department which should be made responsible for the work of annual maintenance or repair and should utilize village panchayats, where they exist, as agencies for carrying out such work. In other words, the First Plan emphasized the need for fixing the responsibility on the beneficiaries for the maintenance and repair work as well as for levying on them water rates. The administrative arrangement envisaged was the placing of the overall responsibility on the Irrigation Department and the carrying out of the day-to-day work through local bodies at the village level.

2.48. *Second Five Year Plan.*—In the Second Plan, some of these suggestions were either directly or indirectly endorsed and a few new ones of a specific nature added. In respect of execution of new works, it was recommended that "systematic surveys are needed with a view to locating suitable minor irrigation works"<sup>14</sup>. The Planning Commission also urged the State Governments to give renewed attention to the paradox arising out of the extension of irrigated area through new works being neutralized by old works falling into disuse. It was specifically suggested that "State Governments should review existing arrangements for the maintenance of minor irrigation works and, where necessary, enact new legislation placing adequate responsibility on village communities". The Planning Commission went much farther in the Second Plan than in the First in suggesting that if the village communities failed to maintain such works, repairs should be undertaken and the cost recovered from the communities concerned. They also repeated in this connection the need for a levy of labour contribution for such purposes. On the planning and administration side, it was emphasized that there should be close co-ordination in the States between the Agricultural Department and the district development staff, so that in each State and district, the programme of minor works and the irrigation targets to be achieved, should be drawn up jointly by these two agencies.

2.49. It appears from a careful perusal of the two Plan reports that in the Second Plan the administrative arrangements were given fairly serious consideration. This is probably due to the fact that by the beginning of the Second Plan, a new administrative agency was operating in this field in all the States. The spread of the Community Development programme, undoubtedly, raised at this stage, new problems of administrative co-ordination and cooperation, in as much as the Development Department added to the number of agencies operating in this field. Some of these problems have been discussed at length in the annual conferences on Community Development, the decision of which will be discussed in appropriate sections.

<sup>13</sup> *First Five Year Plan* pp. 251.

<sup>14</sup> *Second Five Year Plan*. pp. 269.

## CHAPTER III

### USE OF MINOR IRRIGATION FACILITIES AND THEIR IMPACT

3.1. It has been hinted in the last two chapters that the available statistics are not adequate for the purpose of assessing the impact of the measures taken and the programmes implemented in respect of minor irrigation under the **Grow More Food Campaign** in the forties and under the two Plans in the fifties. Since there exists very little information on minor irrigation works going out of use and the reasons thereof, it is difficult to assess the real situation. In structuring this report it has, therefore, been decided to introduce the field problems with a picture of the position regarding the use of minor irrigation works and their impact on the cropping pattern. The account to be presented of the use and the impact of minor irrigation facilities is based on the data collected from 126 villages in 42 sample blocks selected from 21 districts in 14 States. The sample design and other aspects of the methodology of the study have been described in the first chapter. It may, however, be added that the nature of the sources of minor irrigation vary from State to State and even among the regions in each State. It is not, therefore, very meaningful to go in for an overall picture based on the total of these 42 blocks, particularly when these were selected keeping in view the more important sources of irrigation taken up for study in each State. The analysis will, accordingly, relate to the sources of irrigation as far as the sample data permit. For each source, special features noticed in the sample areas in different States will be discussed in relevant sections. It should be noted that State tube-wells have not been included among the sources considered in this chapter. They will be discussed in Chapter VIII.

3.2. The two sources which have figured very largely in the sample data are tanks and wells—pucca as well as kutchha wells. Tube-well and other sources have been found only to a limited extent in the sample villages. The broad distribution of these sources among our sample areas in different States are given in Table 3.1.

**TABLE 3.1**

*State-wise Distribution of Works Existing in the Sample Villages in 1960-61*

Sample areas in States	No. of works by type						Total
	Tank	Pucca well	Kutchha well	Tube-well	Pump set	Other sources*	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Andhra Pradesh .. ..	93	62	1,087	0	0	2	1,244
Assam .. ..	0	0	0	0	6	0	6
Bihar .. ..	17	147	3	7	3	6	183
Gujarat .. ..	1	105	39	0	0	0	145
Kerala .. ..	19	26	7	0	0	3	55
Madhya Pradesh .. ..	11	201	266	0	5	1	484
Madras .. ..	21	252	112	0	0	0	385
Maharashtra .. ..	0	51	12	0	0	3	66
Mysore .. ..	5	85	124	0	0	1	215
Orissa .. ..	10	7	166	0	0	3	186
Punjab .. ..	0	289	0	8	6	0	303
Rajasthan .. ..	1	270	37	0	0	0	308
Uttar Pradesh .. ..	22	134	2	2	0	0	160
West Bengal .. ..	57	15	28	6	0	10	116
All States sample ..	257	1,644	1,883	23	20	29	3,856

\*Other sources include ahars, pyne, bandharas and small bunds.



It will appear from the data in Table 3.1. that the tanks in our sample are largely distributed in the South, in the States of Andhra, Kerala, Madras and Mysore, and among the States in the North in West Bengal, Orissa, U.P. Bihar and M.P. The distribution of wells covers our sample areas in Bihar, Rajasthan, U.P., M.P., Punjab, Gujarat, Madras, Andhra, Maharashtra and Orissa. Tube-wells, pump sets and other sources have been found to be much fewer in number in the sample areas and also not uniformly distributed.

3.3. It is against this pattern of distribution of the minor irrigation works in the sample that the generalisations or inferences derived from the data will have to be interpreted. We shall try, as far as possible, to draw pictures separately for the two important sources, tanks and wells, the data on which will, for a few items, be presented State-wise also. But the frequencies of different works in the State-wise cells are not large enough to permit detailed analysis separately for each State.

#### NATURE AND USE OF IRRIGATION WORKS

3.4. Data on the nature and use position of the minor irrigation works have been collected from the sample villages. All the minor irrigation works in those villages were listed, and the relevant data obtained for them individually for the bigger works and severally for the wells. These enable us to analyse the minor works and facilities existing in the sample villages by type of works, the nature and ownership of these, the levels of availability and utilization of these facilities and the proportion that existed in 1955-56. It should be noted that the term "nature of the irrigation facility" has been used by us to mean whether the sources are perennial or seasonal (Kharif or Rabi). By the 'level of availability of irrigation' is meant the extent to which the cultivated area is covered by irrigation, while the 'level of utilization' relates to the extent to which the irrigation potential created under different sources is utilized.

3.5. Figures showing the total number of works existing in the sample villages in 1960-61 and the number of those in use are given in Table 3.2. Data on the number of works existing in 1960-61 in these villages were obtained from the available records and from knowledgeable persons wherever the records did not exist or contain such statistics. Information on the works in use in 1960-61 was obtained from the knowledgeable persons and cultivators through the consensus method.

TABLE 3.2

*Minor Irrigation Works Existing and those in Use in 1960-61*

Type of works	No. of works existing	Works in use	
		No.	% of those existing
(1)	(2)	(3)	(4)
Tanks .. .. .	257	245	95
Pucca wells .. .. .	1,644	1,518	92
Kutcha wells .. .. .	1,883	1,559	83
Tube-wells .. .. .	23	23	100
Pump sets .. .. .	20	20	100
Others .. .. .	29	28	97
TOTAL ..	3,856	3,193	88

It appears from the table that of all the existing works the proportion in use was nearly 88 per cent in 1960-61. In other words, about 12% were out of use. The lowest proportion of works in use (83%) was found in the case of kutchha wells and the highest (100%) in the case of tube-wells and pump sets. The proportion for pucca wells was 92%, for tanks 95%, and for other sources 97%. Wells show the highest proportion out of use and more so, the kutchha wells. Wells constitute also the most numerous group among the works.

#### OWNERSHIP OF MINOR WORKS

3.6. The use and maintenance position of minor works are often considered to be related to the nature of their ownership. Details of ownership of different types of works are given in the Appendix table C-2 separately for each State. The summary picture is given in Table 3.3.

TABLE 3.3

*Distribution of Tanks, Pucca and Kutchha Wells by Ownership Type*

Type of ownership	Tanks	Pucca wells	Kutchha wells
(1)	(2)	(3)	(4)
Government .. .. .	56.8 (1)	0.6	2.8
Panchayat .. .. .	12.8 (2)	0.2	0.0
Private-individual .. .. .	11.7	52.5	79.8
Private-joint .. .. .	18.7	46.7	17.4
Total .. .. .	100.0	100.0	100.0
No. in sample .. .. .	257	1,644	1,883

(1) Includes 16 Inamdari tanks, ownership of which is in dispute between the Government and the owners.

(2) Includes 1 tank owned by a temple.

The majority of the tanks (57%) in 1960-61 were Government owned; and the proportion owned by panchayats or local bodies accounted for another 13%. Only 30% of the tanks were, therefore, privately owned, and these were shared in the ratio 2.5 : 4 by individual and joint owners in the private sector. The higher proportion of tanks under private-joint ownership than under private-individual ownership may be attributed to their relatively high cost, size and the operation of the law of succession. In the case of pucca wells, almost all the wells were owned privately (99%); and the majority (53%) of them owned individually. Of kutchha wells, nearly 97% were privately owned. Single individual ownership was relatively higher for kutchha than for pucca wells, the proportion of kutchha wells under individual ownership being about 80%. This suggests that there exists a relationship between the cost and size of work and the ownership. The lower the cost per work the greater the chance of private ownership accounting for it. It may be added here that the share of the Government sector in the ownership of tanks has increased considerably during the last few years as a result of the land reform measures.

3.7. The nature and distribution of ownership show considerable variation among the States as can be seen from the data in Table 3.4.

TABLE 3.4

*Number and Percentage of Tanks under each Type of Ownership in 1960-61 by State*

Sample areas in States	Type of Ownership									
	Government		Panchayat		Private-individual		Private-joint		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Andhra Pradesh	87	93.5	6	6.5	0	0.0	0	0.0	93	100.0
Madras	20	95.2	1	4.8	0	0.0	0	0.0	21	100.0
Mysore	5	100.0	0	0.0	0	0.0	0	0.0	5	100.0
Kerala	5	26.3	1*	5.3	11	57.9	2	10.5	19	100.0
Uttar Pradesh	0	0.0	20	90.9	2	9.1	0	0.0	22	100.0
West Bengal	10	17.5	0	0.0	6	10.5	41	72.0	57	100.0
Other States	19	47.5	5	12.5	11	27.5	5	12.5	40	100.0
All States sample	146	56.8	33	12.8	30	11.7	48	18.7	257	100.0

\*Owned by a temple.

In the case of tanks, nearly 83% in West Bengal and 68% in Kerala were under private ownership. In West Bengal, the bulk of the tanks under private ownership were owned jointly, while the opposite was the case in Kerala. In U.P., however, nearly 91% of the tanks in 1960-61 were under panchayat ownership; in fact it is only in this State that panchayats emerge significantly in the ownership of tanks. In the remaining States, the tanks were owned almost exclusively by the Government. It should be noted that the data in Table 3.4. include 16 tanks in Andhra, the ownership of which was in dispute between the Government and the Inamdars, an instance of the effect of land reforms. In the case of wells, the importance of private ownership is noticed in all the States. The only significant proportion under Government ownership was 3% of kutchha wells; and these were all located in the sample areas in Madhya Pradesh. But the relative share of single and joint ownership shows some variation among the States. This can be explained in relation to cost and size of the works, as has been mentioned in the last paragraph.

#### OWNERSHIP AND USE OF WORKS

3.8. The distribution of tanks and wells under different categories of ownership at the time of enquiry is shown in Table 3.5 according as they were in use or not.

TABLE 3.5

*Distribution of Tanks and Wells by Ownership and by Use Position, 1960-61*

Type of Ownership	Use Position					
	In use		Out of use		Total	
	No.	%	No.	%	No.	%
(1)	(2)	(3)	(4)	(5)	(6)	(7)
TANKS						
Government ..	135 (92.5)	55.1	11 (7.5)	91.7	146 (100.0)	56.8
Panchayat ..	32* (97.0)	13.1	1 (3.0)	8.3	33 (100.0)	12.8
Private-individual ..	30 (100.0)	12.2	0	0.0	30 (100.0)	11.7
Private-joint ..	48 (100.0)	19.6	0	0.0	48 (100.0)	18.7
TOTAL ..	245 (95.3)	100.0	12 (4.7)	100.0	257 (100.0)	100.0
PUCCA WELLS						
Government ..	7 (70.0)	0.5	3 (30.0)	2.4	10 (100.0)	0.6
Panchayat ..	4 (100.0)	0.3	0	0.0	4 (100.0)	0.2
Private-individual ..	820 (95.0)	54.0	43 (5.0)	34.1	863 (100.0)	52.5
Private-joint ..	687 (89.6)	45.2	80 (10.4)	63.5	767 (100.0)	46.7
TOTAL ..	1,518 (92.3)	100.0	126 (7.7)	100.0	1,644 (100.0)	100.0
KUTCHA WELLS						
Government ..	28 (52.8)	1.8	25 (47.2)	7.7	53 (100.0)	2.8
Panchayat ..	0	0.0	0	0.0	0	0.0
Private-individual ..	1,261 (83.9)	80.9	242 (16.1)	74.7	1,503 (100.0)	79.8
Private-joint ..	270 (82.6)	17.3	57 (17.4)	17.6	327 (100.0)	17.4
TOTAL ..	1,559 (82.8)	100.0	324 (17.2)	100.0	1,883 (100.0)	100.0

\*Includes 1 tank owned by a temple.

(Figures in brackets indicate the percentages 'in use' and 'out of use' against each ownership type).

Out of the 12 tanks in the out of use category, 11 were owned by the Government, and one by the panchayat. In the case of pucca wells, 3 out of 10 (30%) Government owned pucca wells were out of use; the corresponding figures for kutcha wells were 25 out of 53 or 47%. It is significant that the proportions of pucca and kutcha wells in out of use state were found to be higher in respect of the Government owned ones than for those under private-individual or private-joint ownership. Again, between the types of ownership, private-individual and private-joint, the proportion of wells pucca or kutcha in out of use state was higher in the case of jointly owned wells. It appears that continuity in the use and maintenance of wells varies inversely with the extent of separation of use from ownership. The interest in the use and maintenance of works like wells by the user seems to decrease with the social distance between him and the owner.

3.9. Details of tanks and wells by their ownership and use position are given in the Appendix Table C-3—C-5 separately for each State. These data show that the proportion of works out of use varies considerably from State to State. The highest proportion of pucca wells, not in use in 1960-61 was, reported in the sample areas in Maharashtra. In this State the proportion of such wells, accounted for by private-individual ownership was more than that under joint ownership; the percentages being nearly 56 and 15 respectively. In Punjab and Rajasthan nearly one-eighth and one-tenth of the total number of pucca wells respectively were out of use in 1960-61. In both the States, the percentage of out of use wells under joint ownership was higher than the corresponding percentage for the wells under individual ownership. This is also true in the case of the sample blocks in Madhya Pradesh. That joint ownership by itself is a factor affecting proper maintenance and resulting in a high proportion of wells getting into the out of use state is to some extent reflected in the case of kutchha wells in many of the States. In the selected blocks of Madhya Pradesh, Rajasthan and Maharashtra, the percentages of kutchha wells in unused state were quite high. In Madhya Pradesh and Maharashtra, however, the number of jointly-owned wells in this condition was proportionately less than those owned individually. In Madhya Pradesh again there was a high proportion of kutchha wells (47%) owned by Government in the out of use category. Compared to other States, the proportions of out of use kutchha wells were high in the selected blocks of Madhya Pradesh (38.7%), Maharashtra (41.7%) and Rajasthan (40.5%).

3.10. In the States of Andhra and Madhya Pradesh, the proportion of tanks in out of use state in the sample blocks was found to be nearly 11 and 9 per cent respectively. This was due, at least partly, to the vesting of the zamindari tanks in the respective State Governments. These remained uncared-for for a long time prior to the abolition of intermediary rights in the States.

#### NATURE OF IRRIGATION FROM MINOR WORKS

3.11. The works in use in 1960-61 do not show a uniform distribution of their irrigation benefits among the seasons. Some works are perennial, used for irrigation both in the Rabi and the Kharif seasons, while some are only seasonal being used either in the Kharif or in the Rabi. The distribution of the works in use in 1960-61 by the nature of irrigation provided by them is shown in Table 3.6.

TABLE 3.6

*Percentage Distribution of Minor Works of Different Type and Nature of Irrigation Provided by Them in 1960-61*

Nature of work	Type of works			All works
	Tank	Well	Others	
(1)	(2)	(3)	(4)	(5)
Perennial .. .. .	51.4	83.3	56.3	80.5
Kharif only .. .. .	24.1	0.6	22.5	2.7
Rabi only .. .. .	24.5	16.1	21.2	16.8
TOTAL .. .. .	100.0	100.0	100.0	100.0

The figures in Table 3.6 show that about 81% of minor irrigation works in 1960-61 were of a perennial nature, the proportion of perennial wells being

highest (83%), followed by other (56%) and tanks (51%). The proportion of minor works irrigating in the Kharif season only was the lowest, 3% and in Rabi only about 17%. About one-half of the tanks was found to irrigate crops either in the Kharif or in the Rabi season, but not in both. It may be noted that the tanks irrigating only in the Rabi season were located mainly in the sample areas in Madras, where there are winter rains. Wells are however, mainly perennial sources irrigating to a very small extent in Kharif. Of the other sources about 21% were irrigating in the Rabi only, as compared to 22% in Kharif and 56% perennial. On the whole, it may be said that wells are more or less perennial sources, while tanks and other works are, relatively speaking, more in the nature of seasonal sources. But among the other words, pump sets and tube-wells are largely perennial.

3.12. *Coverage by Irrigation Works*.—An idea of the extent to which irrigation facilities were provided by minor works in 1960-61 can be obtained by relating the number of works in use and their coverage to the net cultivated area. Figures showing the number of minor irrigation works per 100 acres of cultivated area and their average potential per work in 1960-61 are given in Table 3.7.

TABLE 3.7

*Number of Minor Irrigation Works in Use per 100 Acres of Net Cultivated Area and the Average Net Potential per work in 1960-61*

Type of work	No. of works per 100 acres of cultivated area	Average irrigable area per work (Acres)
(1)	(2)	(3)
Tank .. .. .	0.22	31.27
Pucca wells .. .. .	1.39	6.13
Kutchra well .. .. .	1.43	1.40
Tube-well .. .. .	0.02	157.95
Pump set .. .. .	0.02	22.53
Others .. .. .	0.03	307.20
All works .. .. .	3.11	9.63

It appears that in the sample areas, the total number of minor works per 100 acres of net cultivated area in 1960-61 was 3.1. The number of kutchra wells was largest, being 1.43 per 100 acres, pucca wells coming very close to it with a figure of 1.39. Tanks and other sources naturally were numerically smaller. Mere number is not, however, an index of the coverage of works or of their relative importance, since the irrigable area of a tank is much higher than that of a well. Other works bandharas, etc.), show among the minor works, the highest irrigation potential per work, the average for 1960-61 being 307 acres per work. Then come tube-wells with an average potential per work of 158 acres, followed by tanks (31 acres), pump sets (23 acres), pucca wells (6 acres) and kutchra wells (1.4 acres).

#### GROWTH OF MINOR WORKS

3.13. An attempt was made in the course of our investigation to collect data with a view to ascertaining the rate of creation and net growth of minor irrigation facilities between 1955-56 and 1960-61. The village schedules provided for the listing of each tank, tube-well, pump set and other works and of the total number of wells in each village at the time of enquiry, and of these the number that existed in 1955-56. It was, however, found out

that while the data obtainable for tanks, tube-wells and pump sets gave a fairly reliable picture of the positions in these two years, those for wells and some of the other sources could not be fully relied on. The data for kutchha wells were, for obvious reasons, not very comparable between these two years. The position was somewhat better in the case of pucca wells because these could be more easily identified, and did not go out of recognition as quickly or as easily as kutchha wells in some areas. An attempt has been made in Table 3.8 to show, in spite of the limitations of data, the number of tanks, tube-wells, pucca wells and pump sets in existence in 1955-56 and in 1960-61.

TABLE 3.8

*Growth of Minor Works by Type—Tanks, Pucca Wells, Tube-wells and Pump Sets between 1955-56 and 1960-61*

Type of works	Minor works in existence and under construction				
	Total No. exist- ing in 1955-56	Total No. exist- ing in 1960-61	No. in 1960-61 as % of those in 1955-56	No. under construc- tion in 1960-61*	
				No.	% to No. in use in 1960-61
(1)	(2)	(3)	(4)	(5)	(6)
Tanks .. .. .	251	257	102.4	0	0.0
Pucca wells .. .. .	1,289	1,644	127.5	21	1.4†
Tube-wells .. .. .	18	23	127.8	1	4.4†
Pump sets .. .. .	6	20	333.3	0	0.0

\*As on the date of enquiry.

†The proportion will increase to 2.2% and 8.7% for pucca wells and tube-wells respectively, if the number completed but not yet commissioned is included in this category.

Between 1955-56 and 1960-61, the number of tanks in the sample areas had increased by 2.4%, pucca wells by about 27%, tube-wells by about 28%. Pump sets, however, had increased nearly three and one-third times. It is significant that the rate of growth of pucca wells and tube-wells was about the same during this period. The growth of these works during this five year period gives us an approximate idea of the annual rate of growth achieved during this period. The average rate per year works out to about 0.5% for tanks, about 5.5% for pucca wells and tube-wells. The rate for pump sets is very high and is not safe to calculate from the very small number in the sample.

3.14. The number of tanks, pucca wells, tube-wells and pump sets under construction in 1960-61 is also shown in Table 3.8. There were no tanks under construction in that year; but a few pucca wells and one tube-well were reported to be in the construction stage. The proportion of works under construction to the number in existence in 1960-61 gives an idea of the state of construction in the particular year. The proportion of the works under construction to the number of wells and tube-wells in the different categories shows a lower proportion than the average rate calculated in the last paragraph, particularly for pucca wells. It should be noted, however, that the figures of works under construction relate to the date of investigation and do not, therefore, show the total rate for the whole year. There is also a seasonality in the construction of works, particularly wells. The position at a point of time may not give a complete picture. This is the reason

why this rate is lower than the average calculated for the last five years. If, however, the figures of the works just completed but not yet commissioned (i.e., water not yet made available) are added, the proportion of wells under construction or near completion goes upto 2.2% for pucca wells and 8.8% for tube-wells.

3.15. Table 3.9 gives a State-wise picture of the pucca wells in use and out of use in 1955-56 and 1959-60. The position in these two periods seems to have remained the same among the different States. The number of pucca wells out of use in both the years was very high in Punjab, Rajasthan, Madhya Pradesh and Maharashtra. It was also appreciable in Bihar and U.P. Between these two years, the number of wells out of use increased in all the States.

**TABLE 3.9**  
*Distribution of Pucca Wells by Use Position among those Existing in 1955-56 and in 1960-61 by State*

Sample areas in States	Wells			
	in use		out of use	
	1955-56	1960-61	1955-56	1960-61
(1)	(2)	(3)	(4)	(5)
Andhra Pradesh ..	40	60	1	2
Assam ..	0	0	0	0
Bihar ..	87	139	5	8
Gujarat ..	70	104	1	1
Kerala ..	26	26	0	0
Madhya Pradesh ..	167	186	14	15
Madras ..	237	252	0	0
Maharashtra ..	17	27	16	24
Mysore ..	53	81	3	4
Orissa ..	7	7	0	0
Punjab ..	162	252	24	37
Rajasthan ..	214	242	25	28
Uttar Pradesh ..	103	127	6	7
West Bengal ..	11	15	0	0
All States sample ..	1,194	1,518	95	126

3.16. It has not been possible for us to derive any estimate of the rate of construction or the rate of falling into disuse of kutch wells. There are a number of difficulties when we talk of kutch wells. In the first place, the definition is not uniform even in the same State and has been noticed in Eastern U.P., where in one district a kutch well, as defined for purposes of assistance by the Block authorities, can have a life time as long as 20 years or 30 years, while in the neighbouring district, it may last only for three or four years. The definitions are given in Appendix A. Secondly, a kutch well in an alluvial tract is very different from a kutch well, for example, in the Maharashtra and Madhya Pradesh areas where the sub-soil is rocky. In these areas, the difference in life-time between a pucca and a kutch well is not as great as in the former tracts. In any case, the figures of the kutch wells under construction in the sample areas as on the date of investigation in 1960-61 show a much higher rate, about 8.1%, than for pucca wells. One can form one's own idea about the rate of replacement of kutch wells from this figure.

3.17. The investigation threw up more reliable data about the wells constructed with financial assistance from institutional sources. The data reveal



that 8.4% of the pucca wells existing on the date of enquiry, and 9.2% of those in use had been constructed with financial assistance during the period 1955-56 to 1960-61. The corresponding proportions for kutchha wells were 2.1 and 2.5 per cent respectively. The distribution of the wells constructed with financial assistance cumulative shown as percentage of the wells in 1960-61 is given in Table 3.10. It appears from the figures that the rate of construction of pucca wells with financial assistance was highest in 1959-60. It was also fairly high in 1957-58 and 1958-59. As for kutchha wells with financial assistance, the rate of construction was highest in 1959-60.

TABLE 3.10

*Year-wise Percentage Distribution of Pucca and Kutchha Wells (Cumulative) Constructed with Financial Assistance during the Period 1955-56 to 1960-61.*

Year	Pucca wells			Kutchha wells		
	Cumulative No.	Percentage to total		Cumulative No.	Percentage to total	
		existing in 1960-61	in use in 1960-61		existing in 1960-61	in use in 1960-61
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1955-56 .. ..	17	1.0	1.1	4	0.2	0.3
1956-57 .. ..	28	1.7	1.8	6	0.3	0.4
1957-58 .. ..	56	3.4	3.7	8	0.4	0.5
1958-59 .. ..	79	4.8	5.2	18	0.9	1.1
1959-60 .. ..	121	7.4	8.0	38	2.0	2.4
1960-61 .. ..	139	8.4	9.2	39	2.1	2.5

#### USE AND IMPACT OF MINOR IRRIGATION

3.18. We have discussed in the last section the use-position and the growth of minor works and facilities. With the creation of new works, the availability of irrigation potential increases. The extent of benefit derived therefrom depends on the nature of the facilities created and the level of their utilization. The data collected on the irrigable area (*i.e.*, the area they could irrigate or, in other words, the irrigation potential) of the minor works existing in the sample villages at the time of enquiry are presented in Table 3.11 by type of works. It should be noted that this table gives figures for minor works separately from those for all works, minor and major, existing in the sample areas.

TABLE 3.11

*Net Irrigable Area per 100 Acres of Net Cultivated Area in 1959-60 by Type of Works*

Works	Net irrigable area as % of net cultivated area	
	Minor works	All works
(1)	(2)	(3)
Tank .. ..	7.0	7.0
Well .. ..	10.6	10.6
Tube-well .. ..	3.4	3.4
Others .. ..	8.4	8.4
Canals .. ..	—	10.4
All sources .. ..	29.4	39.8
No. of States with level below the average	7	8
Total number of States .. ..	14	14

For the sample area as a whole, about 29% of the net cultivated area in 1959-60 could be covered by the minor irrigation works and 40% by all works (major and minor) existing on the date of enquiry. In the sample areas, nearly 10% of the net cultivated area was covered by the irrigation potential of canals and other major sources.

3.19. The coverage of net cultivated area by the potential of the minor works shows a wide variation among the States, as will be evident from the data given in Appendix table C-7. At one extreme is Punjab where about 85% of the net cultivated area was covered in 1959-60 by the irrigation potential of the minor works against 50% covered by canals. At the other extreme is Kerala with a proportion of only 6%. The coverage was fairly high in States like Bihar (60%), Andhra (41%), Orissa (39%), Mysore and Maharashtra (34%). Four of the States showing coverage of minor works at the lower end of the scale are Kerala (6%), Assam (11%), Gujarat (12%) and Madhya Pradesh (12%). It should be noted that these figures relate to net irrigable area as proportion to net cultivated area, and have been worked out from the data collected for the different works in each village.

#### UTILIZATION OF THE POTENTIAL OF THE MINOR WORKS

3.20. The utilization of the irrigation potential created by the works is more important than the potential itself. For an analysis of this problem, the irrigation potential of the minor works existing in the sample villages has been calculated on the basis of the existing capacity separately for the Rabi and the Kharif seasons and estimates of the extent of utilization of the potentials in the two seasons have been derived from the differences between these figures and those of the area actually irrigated. The relevant data are given in Table 3.12. It should be mentioned here that the irrigation potential of minor works (excluding canals, etc.), in the Kharif and Rabi seasons have been calculated on the following assumptions:—

- (a) The irrigable area of tanks characterised as perennial has been divided between the two seasons—Kharif and Rabi—on the basis of the area actually irrigated in the two seasons from tanks in the relevant State.
- (b) Works which are characterised as Kharif only, have been left out from the irrigation potential of Rabi; and similarly works meant for Rabi only have been excluded from the calculation of the Kharif potential. The proportion of irrigation potential unutilized has been calculated on the basis of the difference between the potential and the actual irrigation in 1959-60.

TABLE 3.12

*Irrigation Potential of Minor Works and its Utilization in Sample Villages in 1959-60*

Sample areas in States	Kharif 1959-60				Rabi 1959-60		Net
	Irrigation potential as % to cultivated area	Area irrigated as % to cultivated area	Irrigation potential unutilized as % to irrigation potential	Irrigation potential as % to cultivated area	Area actually irrigated as % to cultivated area	Irrigation potential unutilized as % to irrigation potential	Irrigable area as % to net cultivated area.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Andhra Pradesh	35.9	28.3	21.3	15.9	13.4	15.8	40.7
Assam	0.0	0.0	N.R.	11.2	3.6	67.4	11.2

(Table—contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bihar ..	56.9	35.1	38.4	26.5	13.0	51.0	60.3
Gujarat ..	10.5	5.0	52.9	11.8	9.0	23.6	11.8
Kerala ..	2.9	0.0	100.0	5.8	4.5	23.6	5.8
Madhya Pradesh ..	11.2	1.2	89.5	10.8	7.5	30.5	11.8
Madras	6.3	4.2	34.5	21.6	17.3	20.0	21.6
Maharashtra ..	34.1	11.1	67.5	34.2	20.3	40.8	34.2
Mysore	31.7	31.0	2.1	17.4	19.9	0.0	34.4
Orissa ..	38.7	17.7	54.3	5.7	0.9	85.0	38.7
Punjab	84.5	38.2	54.8	84.5	39.7	53.0	84.5
Rajasthan	16.9	1.1	91.4	17.3	15.9	0.2	17.4
Uttar Pradesh	17.8	12.4	30.3	20.7	16.4	20.5	20.4
West Bengal ..	30.8	9.6	69.1	11.6	19.1	0.0	31.9
All States sample	26.2	12.0	54.1	22.3	15.5	30.3	29.4

N.R.=Not relevant.

It appears from the figures in Table 3.12 that in the sample areas nearly 54% of the irrigation potential remained unutilized in the Kharif season of 1959-60, as compared to 30% in the Rabi. Under-utilization of irrigation potential was thus much higher in the Kharif than in the Rabi season.

3.21. The data for the different States given in Table 3.12 show a wide disparity in the utilization of the irrigation potential of minor works. Thus, in the Kharif season the proportion of potential not utilized in 1959-60, was as high as 100% in Kerala and 90% in Madhya Pradesh. This assessment is based on the assumption that the irrigation potential of the works in the Kharif season is the same as in Rabi. From some areas of Rajasthan, we have, however, received reports that the Irrigable area in the Kharif is lower than that in the Rabi. The exact proportion of the Kharif to the Rabi potential could not, however, be ascertained, but in our calculations it has been assumed to range between 50% to 80%. On this basis the figure for potential unutilized in Kharif for Rajasthan came to 91%. The lowest proportion of under-utilization in the Kharif season was recorded in the sample areas in Mysore (2%). It was also fairly on the low side in Andhra (21%), U.P. (30%), Madras (35%) and Bihar (38%). In the remaining States the proportion was above 50%. In the Rabi season, however, the proportion was found to be generally lower for all the States except Assam, Bihar and Orissa. According to the figures in Table 3.12, utilization of the Rabi potential in 1959-60 was full (100%) in the sample areas in Mysore and West Bengal and very high in Rajasthan (92%). Surprisingly, the figures for the degree of under-utilization in Punjab are on the high side and about the same in both Kharif and Rabi. There may be some amount of non-comparability among the figures for different States. Probably the figures of potential for minor works are not fixed on a uniform basis in different States. It has been observed, for example, that the potential for the different works in States like Punjab is fixed somewhat on the high side and may be the principal reason for the relatively high figure of the proportion of the potential remaining unutilised in such States.

3.22. *Differences in the Proportion of Utilization between Major and Minor Works.*—In some of the sample villages, major sources of irrigation like canals were also found to exist. It has already been pointed out that 10.4% of the net cultivated area in the sample villages were covered by the irrigation potential of canals. Canals have been found to be an important source of irrigation in the selected villages and blocks in Andhra, Madhya Pradesh, Punjab, Rajasthan and U.P. Canals were found to irrigate more than 50% of the cultivated area in the sample in Punjab and about 25% in U.P. and Rajasthan. From the data, given below, about the extent of utilization in 1959-60 of the irrigable area of canals and that of the minor works in the sample areas in the above States, it will appear that the extent of utilization of the potential of the canals in the Kharif season was much higher in Andhra, Madhya Pradesh and U.P., but lower in Punjab and Rajasthan. In the Rabi, however, the extent of utilization of the potential of the minor works was much higher than that of canals in these five States. The weighted average (weighted by the proportion of irrigable area in the two seasons) of utilization in the two seasons shows a uniformly higher proportion of irrigation potential utilized from the minor works than from the canals. This seems to support the general notion that the utilization of irrigation potential is higher for minor than for major works.

TABLE 3.13

*Comparison of Major and Minor Works in respect of Degree of Utilization of Irrigation Potential in 1959-60*

Sample areas in States	Percentage of potential area irrigated in 1959-60					
	Kharif		Rabi		Weighted average of seasons	
	Canal	Minor works	Canal	Minor works	Canal	Minor works
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Andhra Pradesh ..	94.9	78.7	9.3	84.2	52.1	80.4
Madhya Pradesh ..	73.0	10.5	0.0	69.5	36.5	39.4
Punjab .. ..	8.7	45.2	5.0	47.0	6.8	46.1
Rajasthan .. ..	0.0	8.6	25.3	99.8	12.6	54.2
Uttar Pradesh ..	102.4	69.7	30.3	79.5	66.3	75.0

3.23. *Utilization of Potential of Tanks and Wells.*—The different types of works vary also in the extent to which their potential is utilized. A comparison of the gap between the potential available and that utilized for the two important types of works viz., wells and tanks, is attempted in Table 3.14. This table presents data on the area irrigated as proportion to the cultivated acreage in Kharif and Rabi seasons separately, along with the proportion of the potential of the works not utilized. The data are given separately for some of the States where tanks and wells are important sources of irrigation. Detailed data for all sources are given in Appendix Table C-21.

TABLE 3.14

*Area Irrigated by Tanks and Wells as Percentage of Cultivated Area and the Proportion of Irrigation Potential Unutilized in Rabi and Kharif in 1959-60*

Sample areas in States	Kharif		Rabi	
	% irrigated to cultivated area	% of potential unutilized	% irrigated to cultivated area	% of potential unutilized
(1)	(2)	(3)	(4)	(5)
<b>TANKS</b>				
Andhra Pradesh .. ..	27.7	0.0	5.6	0.0
Kerala .. ..	0.0	N.R.	2.9	3.3
Madras .. ..	0.0	N.R.	15.2	0.0
Mysore .. ..	16.4	3.9	5.4	0.0
Orissa .. ..	12.4	60.5	0.0	N.R.
<b>WELLS</b>				
Bihar .. ..	6.3	85.0	11.4	37.3
Madhya Pradesh .. ..	0.3	97.8	7.1	29.4
Gujarat .. ..	5.0	52.9	7.8	25.9
Punjab .. ..	37.4	31.1	38.8	40.9
Rajasthan .. ..	1.1	91.4	15.6	0.2
Uttar Pradesh .. ..	12.4	39.4	14.4	17.7

N.R. = Not relevant.

It will be observed from Table 3.14 that tanks are used predominantly for Kharif irrigation in Andhra, Mysore and Orissa, among the States included in the Table; while in Kerala and Madras they are used mainly for Rabi irrigation. The proportion of the potential remaining unutilized in the Kharif season of 1959-60 was very high in Orissa (62%). In Mysore, however, only 4% of the Kharif potential remained unutilized in 1959-60. In the Rabi, the potential was fully utilized except in Kerala where about 3% was not used.

3.24. Well irrigation in the Kharif season is fairly extensive in Punjab and U.P., and is also relatively important in Bihar and Gujarat. In all the States shown in Table 3.14, however, wells are much more important for Rabi irrigation than for Kharif. The utilization of the potential of wells in 1959-60 was in every State higher in the Rabi season than in the Kharif, the only exception being Punjab. The proportion of under-utilization of the Kharif potential of wells was very high in Rajasthan, Madhya Pradesh and Bihar, and relatively low in Punjab and U.P. It is interesting to note that in the Rabi season the proportion of the potential unutilized was lowest in Rajasthan and highest in Punjab. In general, it may be said that well water is used for irrigation in both Rabi and Kharif seasons in Punjab and U.P., whereas in the other States they are used largely for Rabi irrigation. The pattern of utilization of the potential of tanks and wells in the different States, it may be added, is related largely to the nature and distribution of rainfall, other climatic factors and the water table in these areas. While it is not possible to generalize on the basis of the figures for only one year, 1959-60, which had a good Kharif season, the data tend to show that the utilization of the irrigation potential of minor works leaves considerable room for increase, particularly in the Kharif season, in some of the States.

## IMPACT OF IRRIGATION

3.25. We shall now pass on to a consideration of the impact of the minor irrigation programme on agriculture during the period 1955-56 to 1959-60. The analysis of the impact will be confined to some of the significant variables like extension of cultivation, extension of irrigation, intensification of cropping and changes in the cropping pattern over this period.

3.26. *Extension of Cultivation.*—An attempt was made to collect in the course of our investigation data regarding increase in the cultivated area in the 126 sample villages. The results of the investigation show increase in cultivated area as well as in area newly brought under cultivation as a result of minor irrigation. The net cultivated area in the sample of 126 villages recorded an increase by about 8% between 1955-56 and 1959-60. Over this period, there had been a rise in the proportion of net cultivated area to the geographical area from 60% to 62%. The areas newly brought under cultivation because of minor irrigation facilities formed 0.02% of the cultivated area in 1955-56 as compared to 0.3% in 1959-60. Similarly, areas reclaimed as a result of minor irrigation extension formed 0.2% of the net cultivated area in the first year and rose to 1.4% in 1959-60. These figures are given in Table 3.15.

TABLE 3.15  
*Extension of Cultivation in the Sample Areas*

Description	Position in	
	1955-56	1959-60
(1)	(2)	(3)
Index of net cultivated area .. .. .	100	108
Net Cultivated area as % of geographical area .. ..	59.5	62.1
Area newly brought under cultivation as % of the net cultivated area .. .. .	0.02	0.3
Area reclaimed as % of net cultivated area .. .. .	0.2	1.4
Index of gross area irrigated .. .. .	100	131
Gross irrigated area as % of gross cropped area .. ..	23.6	24.8

3.27. *Extension of Irrigation.*—It will also appear from the figures given in Table 3.15 that the gross area irrigated increased by about 31% between 1955-56 and 1959-60. The proportion of the gross cropped area irrigated increased over this period from 23.6 to 24.8 per cent. In general, therefore, there was an increase in the extension of cultivation as well as of irrigation. This will also be apparent from the distribution of the number of blocks in the sample by the proportion of net cultivated area irrigated given in Table 3.16. While the proportion of the blocks having less than 10% and less than 25% of the net cultivated area irrigated in 1955-56 was 32.5 and 62.5 per cent, the corresponding figures for blocks in 1959-60 were 29.3% and 58.6% respectively. The proportion of blocks with more than 25% of the net cultivated area irrigated, increased from 37.5% in 1955-56 to 41.4% in 1959-60.

TABLE 3.16

*Distribution of Sample Blocks by the Proportion of Net Cultivated Area Irrigated in 1955-56 and 1959-60*

% of net cultivated area irrigated	Blocks			
	1955-56		1959-60	
	No.	%	No.	%
(1)	(2)	(3)	(4)	(5)
Below 10% .. .. .	13	32.5	12	29.3
10-25% .. .. .	12	30.0	12	29.3
25 % and above .. .. .	15	37.5	17	41.4
TOTAL .. .. .	40	100.0	41	100.0

3.28. *Gross Cropped Area Irrigated.*—The proportion of the gross sown area or cropped area irrigated by all sources in the sample areas increased steadily from 23.6% in 1955-56 to 25.0% in 1958-59, as the figures in Table 3.17 show. It went down slightly to 24.8% in 1959-60. While the overall figures show a steady rise upto 1958-59 and a higher level in 1959-60 than in 1955-56, a few States, namely, U.P., West Bengal, Andhra and Rajasthan, show an actual decline. In Madras, the figure rises upto 1958-59. The steep decline in 1959-60, shown in the table, is to be read with caution because data for the earlier years could not be available for a block which in 1959-60 had very little irrigation (only 11%). In Madhya Pradesh, on the other hand, the rise was maximum—almost double, but mostly contributed by one block out of six. Of course, the percentage of the total gross cropped area receiving irrigation facility in Madhya Pradesh was small and to that extent the scope for further rise was greater.

TABLE 3.17

*Proportion of Gross Cropped Area Irrigated, by State, 1955-56 to 1959-60*

Sample areas in States	% gross cropped area irrigated				
	1955-56	1956-57	1957-58	1958-59	1959-60
(1)	(2)	(3)	(4)	(5)	(6)
Andhra Pradesh ..	43.8	43.9	39.0	38.9	40.4
Bihar .. .. .	30.1	33.6	35.5	35.9	32.8
Gujarat .. .. .	12.2	9.1	8.7	9.1	10.2
Kerala .. .. .	5.8	6.3	6.6	6.5	6.5
Madhya Pradesh ..	7.2	7.6	8.0	7.8	13.6
Madras .. .. .	N.A.	45.1	51.6	52.4	34.0
Maharashtra .. ..	5.0	4.3	5.5	5.7	8.9
Mysore .. .. .	21.7	26.6	20.6	18.6	22.9
Orissa .. .. .	34.7	28.6	31.9	28.1	33.3
Punjab .. .. .	51.5	53.6	46.2	52.3	49.7
Rajasthan .. .. .	24.6	23.8	21.7	22.2	18.6
Uttar Pradesh .. ..	36.7	34.5	35.8	27.9	30.4
West Bengal .. ..	26.3	27.2	26.4	23.6	23.6
All States sample ..	23.6	24.8	24.9	25.0	24.8

N.A. = Not available.

3.29. The gross cropped area irrigated in a year gives only an overall picture. It has to be supplemented by its seasonal break-up between Kharif and Rabi. Table 3.18 presents for the two years, 1955-56 and 1959-60, data on area actually irrigated as percentage to the cropped area in Kharif and Rabi seasons separately.

TABLE 3.18

*Proportion of Cultivated Area Irrigated in Kharif and Rabi, 1955-56 and 1959-60*

Sample areas in States	Percentage of area actually irrigated to cultivated area*			
	1955-56		1959-60	
	Kharif	Rabi	Kharif	Rabi
(1)	(2)	(3)	(4)	(5)
Andhra Pradesh .. .. .	31.7	8.3	31.3	13.7
Bihar .. .. .	39.0	5.9	38.2	13.5
Gujarat .. .. .	2.8	6.2	5.0	9.0
Kerala .. .. .	0.5	2.5	0.0	4.5
Madhya Pradesh .. .. .	3.7	7.5	6.6	7.5
Madras .. .. .	N.A.	N.A.	4.2	17.3
Maharashtra .. .. .	11.0	20.1	11.1	20.3
Mysore .. .. .	26.4	14.5	31.0	19.9
Orissa .. .. .	17.8	0.8	17.7	0.9
Punjab .. .. .	26.9	24.9	43.3	42.7
Rajasthan .. .. .	1.4	27.5	1.1	22.5
Uttar Pradesh .. .. .	28.4	27.7	41.5	25.0
West Bengal .. .. .	22.7	1.8	11.8	19.1
All States sample .. .. .	15.9	14.2	15.1	17.2

N.A. = Not available.

\*Includes all sources of irrigation minor and canals.

3.30. In the sample villages taken together, the proportion of cultivated area receiving irrigation benefit in Kharif season remained, more or less the same, at 15% between 1955-56 and 1959-60 (if at all, there was a slight decline from 16% to 15%). But the figure for the Rabi irrigation shows a rise from 14% to 17%. To the extent Rabi irrigation is more crucial, this shows a desirable line of progress. Among the States, a few have recorded a very significant rise. In the sample blocks of Punjab, the proportion of Rabi area irrigated increased from 25% to 43%. In Bihar, only 6% of the cultivated area received irrigation during the Rabi season in 1955-56; but in 1959-60, 14% of the cultivated area got the benefit. Increases are recorded also in Andhra, and Gujarat. On the other hand, in Rajasthan and U.P., Rabi irrigation seems to have declined relatively over this period. In U.P., however, Kharif irrigation recorded a substantial increase; but in Rajasthan it remained constant. Further, in a few States like Maharashtra and Orissa, Irrigation benefit shows no improvement over this period in either season. The data in Table 3.18 show that among the States, Punjab and U.P., have recorded relatively better results in Kharif irrigation, closely followed by Bihar, Andhra and Mysore. Rajasthan and Gujarat fair rather badly. In Rabi irrigation, the best progress is recorded again by Punjab, Rajasthan and U.P. coming next.

3.31. *Area Sown More than Once.*—In the 126 sample villages, the proportion of net cultivated area sown more than once had gone up from



16.6% in 1955-56 to 17.7% in 1959-60. Table 3.19 shows the proportions separately for the irrigated and the unirrigated areas in the sample.

TABLE 3.19

*Proportion of Area Sown More Than Once, to the Cultivated Area, Separately for the Irrigated and Unirrigated Areas*

Irrigation category	Year	
	1955-56	1959-60
(1)	(2)	(3)
Irrigated areas .. .. .	31.0	36.2
Unirrigated areas .. .. .	12.1	12.1
TOTAL .. .. .	16.6	17.7

The figures in Table 3.19 show that the intensity of cropping has been higher in the irrigated tracts than in the unirrigated ones, which is to be expected. Over the five year period, 1955-60, there had been no change in the extent of multiple cropping in the unirrigated areas. In the irrigated areas, however, it had gone up by nearly 5 points from 31.0 per cent to 36.2 per cent.

3.32. The figures of intensity of cropping is, however, affected by the cropping pattern to some extent. If a substantial proportion of the cultivated area is under long standing crops like sugarcane, the intensity will be low unless these are equated to more than one crop. For a strict comparison over time, the area under such crops has to be examined, and changes therein allowed for. The proportion of cultivated area under sugarcane in the sample, however, remained about the same in both the years, 1955-56 and 1959-60 (2%). The comparative picture given by Table 3.19 is not therefore, distorted by this factor to any significant extent.

3.33. *Cropping Pattern.*—For assessing changes in the cropping pattern, data were collected on areas under different crops for each of the years, 1955-56 to 1959-60. The data on the distribution of these are presented in Table 3.20 for all the sample areas taken together. Similar data for each of the States covered in our sample are given in Appendix Tables C-8 to C-20.

Data in Table 3.20 show that the share of paddy in the total gross cropped area had increased from 19.3% in 1955-56 to 21.6% in 1959-60; of groundnut from 3.8% to 5.6%; but that of wheat decreased from 13.9% to 9.5%. The relative importance of jowar, bajra and maize had, on the whole, remained unchanged. Sugarcane, cotton, gram and potato seem to show a relative decline to a very small extent. The other crops, however, show a rise in relative importance. While this is the general pattern, the fluctuations from year to year were not consistent in all cases, except for paddy, wheat, groundnut, gram, sugarcane and cotton.

3.34. A perusal of the State-wise figures reveals that the rise in the share of paddy had occurred not in States like Andhra or Orissa where its share in gross cropped area was already high, but in States like Punjab, Mysore and U.P. In our Punjab sample, the share of paddy increased from 3.4 to 4.1% of the area over this period; in Mysore, from 9 to 11.5%; and in U.P. from 20.6 to 24.6%. In the sample areas of Andhra and Orissa, the relative share of paddy cultivation during this period shows a slight decline.

TABLE 3.20  
*Distribution of Sown Area by Crops, along with Proportion of Area Irrigated for Each Crop, 1955-56 to 1959-60*

Year	% of gross cropped area irrigated	Paddy	Wheat	Sugarcane	Cotton	Jowar	Bajra	Maize	Groundnut	Gram	Potato	Others
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1955-56	23.6 (a)	19.3	13.9	2.1	6.7	10.4	4.5	4.6	3.8	7.6	0.2	26.9
	(b)	45.4	44.3	89.0	13.0	0.1	0.0	17.6	0.0	4.8	97.1	16.8
1956-57	24.8 (a)	19.7	12.2	1.9	7.9	9.7	5.5	3.7	4.3	7.1	0.2	27.8
	(b)	50.5	41.2	88.8	22.6	4.0	0.3	18.9	0.4	3.5	88.6	17.0
1957-58	24.9 (a)	21.5	10.1	1.9	6.2	12.0	4.6	4.3	5.5	6.2	0.2	27.5
	(b)	52.9	43.7	84.7	22.0	3.4	0.1	23.2	0.1	4.5	96.9	15.3
1958-59	25.0 (a)	21.4	9.7	2.0	6.0	11.4	4.3	4.6	6.3	5.3	0.1	28.9
	(b)	52.6	40.7	85.6	29.0	1.8	0.4	20.7	1.3	4.4	96.2	16.5
1959-60	24.8 (a)	21.6	9.5	1.9	5.9	10.4	5.3	4.5	5.6	6.2	0.1	29.0
	(b)	52.9	44.3	86.9	26.3	3.2	0.7	20.4	1.5	4.7	95.7	14.5

(a) Percentage of area under a crop to total gross cropped area.

(b) Percentage of the irrigated area under a crop to the total area under that crop.

3.35. As regards the extent of irrigation of the different crops, paddy shows an increase from 45.4 to 52.9% between 1955-56 and 1959-60, while wheat records more or less the same proportion in the two years with a decrease in the intervening years. There had also been a slight decrease in the case of sugarcane, while maize seems to have recorded an increase. In 1955-56, only 13% of cotton area received irrigation, against 26% in 1959-60. Groundnut was not irrigated at all in the first year; but 1.5% of the groundnut area received irrigation in 1959-60. It may be said that better irrigation facilities resulted partly in a shift of acreage in favour of paddy and partly in the intensification of irrigation on some of the "cash" or commercial crops.

3.36. *Introduction of New Crops.*—Introduction of new crops is another aspect of the impact of irrigation. Even if the new crops cover small areas, they may qualitatively serve as an evidence of change and as such deserve mention. The data from the sample villages show that new crops had been introduced in 12 out of 42 blocks under study between 1955-56 and 1959-60. In nine of these 12 blocks, the newly introduced crops were fully irrigated. It may not, therefore, be wrong to presume that but for the availability of irrigation facilities, these crops might not have been introduced in these blocks. On the other hand, sugarcane which had been newly introduced in Falakata and mesta in Kumargram blocks of West Bengal and cotton in Bhiloda block of Gujarat, are reported to have been unirrigated.

TABLE 3.21  
*Coverage of Cultivated Area and Irrigated Area by Newly Introduced Crops, in 1959-60*

Block	Crops newly introduced	Percentage to cultivated area	
		Total area under the crop	Irrigated area under the crop
(1)	(2)	(3)	(4)
Sangam (Andhra Pradesh) .. ..	Sunhemp	2.67	2.37
	Banana	0.09	0.09
Parkal (Andhra Pradesh) .. ..	Chillies	1.68	1.68
Mayong (Assam) .. ..	Boro Paddy	1.16	1.16
Badnawar (Madhya Pradesh) .. ..	Opium	0.12	0.12
Sidhlaghatta (Mysore) .. ..	Potato	0.14	0.14
Attmallik (Orissa) .. ..	Potato	0.01	0.01
Doraha (Punjab) .. ..	Paddy	0.41	0.41
Sawai Madhopur (Rajasthan) .. ..	Onions & Potato	0.002	0.002
	Peas	0.03	0.03
Falakata (West Bengal) .. ..	Sugarcane	0.47	0.00
Kumargram (West Bengal) .. ..	Mesta	1.21	0.00
Bhiloda (Gujarat) .. ..	Cotton	1.52	0.00
Rajapalayam (Madras) .. ..	Cashewnuts	0.03	0.03

3.37. In one block (Sangam, Andhra), the proportion of area under newly introduced crops was nearly 3 per cent of the gross cropped area in 1959-60. In four blocks, this proportion was between one and two per cent and was very small (negligible) in the remaining seven blocks. Potato was the most common among the newly introduced crops in these areas, followed by paddy.

3.38. *Shift in the Importance of Minor Irrigation Source.*—The irrigation facilities made available during the five years since 1955-56 may be expected to have had an impact not only on the cropping pattern but also on the irrigation practices. There might have been shifts in the relative importance of different sources of irrigation. An attempt has been made to analyse this aspect in Table 3.22 which gives the percentage figures of total irrigated area served by different sources for the two years 1955-56 and 1959-60 and changes in their relative importance.

TABLE 3.22  
*Percentage Distribution of Gross Irrigated Area Under Minor Works by Source*

Source	1955-56	1959-60	Index for 1959-60 with 1955-56 base
(1)	(2)	(3)	(4)
Tanks .. .. .	22.7	29.9	175.6
Wells .. .. .	43.4	41.8	128.2
Tube-wells .. .. .	8.7	7.2	111.2
Others .. .. .	25.2	21.1	111.0
TOTAL .. .. .	100.0	100.0	133.2

It appears that the gross irrigated area from sources other than canal had gone up by about 33% over this period. The increase had been highest in respect of areas irrigated from tanks (75.6%) and lowest in areas served by other sources excluding canal (11%). Though areas irrigated from each source mentioned in Table 3.22 increased as can be seen from the figures in col. 4, the percentage share in the total irrigated area in 1959-60 over that in 1955-56 increased only in the case of tanks. Tanks have thus gained in relative importance. This gain might have resulted either from a relatively larger rate of creation of new works or from a higher tempo of restoration of old works. The relative importance of the two can be gauged to some extent by the fact that nearly 98% of the total number of tanks existing in 1959-60 existed in 1955-56 also. It should, however, be understood that even in 1959-60, wells remained the most important single source. About 37% of the total irrigated area got irrigation water from wells, against about 27% only from tanks.

#### COMPARISON OF THE ESTIMATES BASED ON DATA FROM DIFFERENT SOURCES

3.39. This section attempts a comparison of estimates based on the data collected through the village schedules with those derived from the patwari records and those from the household schedules. The patwari or village records were available for all States except Kerala, Orissa and West Bengal. Our village Schedule provided for the collection of crop and irrigation data contained in the patwari records. In addition, it sought independent data based on a census of minor works. For the household schedule, data were collected through personal interview. The variables compared are (i) proportion of net area irrigated to net cultivated area, (ii) the proportion of the gross unirrigated area to the gross cropped area, (iii) percentage of area sown more than once to cultivated area, and (iv) cropping pattern.

3.40. *Proportion of Net Area Irrigated to Cultivated Area.*—Figures of the proportion of net area irrigated to net cultivated area in 1955-56 and 1959-60 as calculated from the village records and the household level data are given below in Table 3.23.

TABLE 3.23

*Proportion of Net Area Irrigated to Net Cultivated Area by All Sources Minor and Major—Different Estimates*

Year							Village records	Household level	
								Random	Knowledgeable
(1)							(2)	(3)	(4)
1955-56	..	..	..	..	..	..	23.7	23.1	31.2
1959-60	..	..	..	..	..	..	23.8	27.2	37.9

The proportion of net area irrigated to cultivated area, as revealed by the figures in Table 3.23, was highest in the case of the knowledgeable group of respondents. This may be partly explained by the fact that the knowledgeable persons are in general the progressive farmers. The random sample estimate based on household schedules and the estimate based on village data are not very different for the year 1955-56. Nor could a comparison of household data collected through the interview method with recorded village data be conclusive for a year as far back as 1955-56. But this point does not hold for 1959-60. The difference in 1959-60 between the estimate of 27.2% derived from household data and of 23.8% from village records is quite significant. To this extent, the village level data may be said to underestimate the extent of irrigation and probably its increase.

3.41. An attempt has been made by us to pursue further the point revealed by the above comparison of the household data with the village data. It is often mentioned in various quarters that the official records on area irrigated, particularly by minor sources, at the village level have certain limitations. It is not always clear whether proper allowance is made in practice for either the area irrigated by newly constructed sources or that ceasing to have irrigation because of the sources going out of use. The figures in Table 3.23 seem to support the general belief that the village records underestimate the actual extent of irrigation. In order to analyse further the extent of the actual discrepancy, we have prepared two sets of estimates of the percentage of the net area irrigated by minor works only to the net cultivated area—one based on the village data obtained from the official agencies and the other based on the area irrigated by the different works listed in our village schedule. There was some difficulty in computing the net irrigated area in a village from the totals of the different works existing in the village. Any overlapping of two or more works in respect of area irrigated was one difficulty. This, however, could be tackled by us on the basis of the detailed data and other information. The other difficulty related to the determination of the net irrigated area from each work source. The procedure followed by us has been to take the maximum of the area irrigated by a work in two seasons as the net irrigated area for

purposes of calculation. The net area irrigated as determined in this manner gives the lower bound of this variable. In case of works with large ayacut or command area like tanks, bandharas, tube-wells and even large wells, this lower bound will be the same as the net area irrigated. The two sets of data thus computed are presented in Table 3.24.

3.42. Data in Table 3.24 reveal that there is a very close agreement—in fact, more or less complete agreement—between the two sets of estimates in respect of sources like tube-wells, and pump sets. These are also very close so far as tanks are concerned. The difference in the case of wells is somewhat larger. But it is only in the case of other sources that the two sets of estimates show a fairly wide divergence. On the whole, the estimates based on official village records are lower than those obtained from the field data regarding works, the former working out to 21.7% against 22.2% shown by the latter. It is only in the case of tanks that the estimate given by the village record is larger than that obtained from the works. In the case of other sources, the estimate obtained from the works is on the higher side.

3.43. The discrepancies between the two sets of estimates are, however, not uniform among the different States. It appears that in States like U.P., Mysore, West Bengal, Maharashtra, Gujarat and Madhya Pradesh, the village records or similar sources tend to underestimate the extent of irrigation from minor works. The degree of underestimation is quite high in U.P. and Maharashtra, though the sources for which this underestimation seems to occur, are different, namely, pucca wells in U.P., and other sources mainly bandharas in Maharashtra. In Assam, the discrepancy between the two sets of figures is largely accounted for by pump sets for which the official figure is not available at the village level. In Mysore, tanks account for the difference between the two sets of estimates. In the other seven States, namely, Andhra, Bihar, Kerala, Madras, Orissa, Punjab and Rajasthan, the village records tend to show a higher level of the proportion of net area irrigated than what has been revealed by our figures based on the works existing in the sample villages. In short, there is evidence to show that in a number of States, the village level data tend to underestimate the extent of net irrigation provided by the minor works; while in some other States, the evidence seems to be somewhat on the other side. The net result seems to be underestimation for the country as a whole, as far as can be judged or generalised from our sample.

TABLE 3.24

*Percentage of Net Irrigated Area to Net Cultivated Area by Different Sources of Irrigation (excluding canal) Based on (a) Village Level Data from Official Agencies (b) Maximum Area Irrigated by the Works in the Two Seasons (1959-60)*

Sample areas in States		% net irrigated to net cultivated area						
		Tank	Pucca well	Kutcha well	Tube-well	Pump set	Others	All sources
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)
Andhra Pradesh	(a)	28.4	0.8	9.3	0.0	0.0	0.4	38.9
	(b)	27.7	0.6	6.7	0.0	0.0	0.4	35.4
Assam	(a)	0.0	0.0	0.0	0.0	N.A.	0.0	0.0
	(b)	0.0	0.0	0.0	0.0	3.6	0.0	3.6
Bihar	(a)	1.8	7.8	0.01	10.4	0.0	28.6	48.6
	(b)	1.7	7.2	0.0	8.4	0.0	28.0	45.3

(Table—Contd.)

(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)
Gujarat	(a)	0.5	5.4	3.4	0.0	0.0	0.0	9.3
	(b)	1.2	8.6	2.0	0.0	0.0	0.0	11.8
Kerala	(a)	5.4	0.1	0.1	0.0	0.0	1.8	7.4
	(b)	2.9	0.6	0.1	0.0	0.0	0.9	4.5
Madhya Pradesh	(a)	0.4	4.6	1.7	0.0	0.0	1.0	7.7
	(b)	1.3	4.9	2.2	0.0	0.0	0.0	8.4
Madras	(a)	15.2	5.4	0.8	0.0	0.0	0.0	21.4
	(b)	15.2	5.2	0.7	0.0	0.0	0.0	21.1
Maharashtra	(a)	0.0	1.6	0.3	0.0	0.0	6.6	8.5
	(b)	0.0	1.4	0.2	0.0	0.0	19.8	21.4
Mysore	(a)	7.6	9.0	6.3	0.0	0.0	0.1	23.0
	(b)	16.4	8.6	6.0	0.0	0.0	0.0	31.0
Orissa	(a)	32.1	0.03	0.8	0.0	0.0	5.2	38.1
	(b)	12.4	0.0	0.6	0.0	0.0	5.2	18.2
Punjab	(a)	0.0	31.8	0.0	14.9	1.4	0.0	48.1
	(b)	0.0	27.7	0.0	15.3	1.1	0.0	44.1
Rajasthan	(a)	0.4	16.9	0.001	0.0	0.0	0.0	17.3
	(b)	0.4	12.4	0.3	0.0	0.0	0.0	13.1
Uttar Pradesh	(a)	2.4	5.1	0.0	0.2	0.0	0.0	7.7
	(b)	2.4	16.3	0.0	4.1	0.0	0.0	22.8
West Bengal	(a)	2.0	0.1	0.5	0.2	0.0	22.8	25.6
	(b)	1.6	0.3	0.3	3.4	0.0	25.2	30.8
All States sample	(a)	6.5	7.3	1.7	1.7	0.1	4.4	21.7
	(b)	6.0	6.9	1.4	1.8	0.1	6.0	22.2

N.A. = Not Available.

3.44. In order to analyse the extent of consistency in the data obtained from the household sample, an attempt has been made by us to obtain separate estimates based on sub-samples of the random sample of households following some of the usual rules of the method of inter-penetrative sampling. Even though the sample was not large enough to permit more than two sub-samples, there was enough of consistency between the estimates obtained from the two sub-samples for each of the years—1955-56 to 1959-60. The figures of the proportion of net area irrigated to the net cultivated area for each of the two sub-samples along with the degree of variation between the estimates derived from them for the years, 1955-56 to 1959-60 are given in Table 3.25.

TABLE 3.25  
Percentage of Net Area Irrigated to Total Cultivated Area by Sub-sample Estimates

Year	S.S.I	S.S.II	Combined	Index of variability
(1)	(2)	(3)	(4)	(5)
1955-56 .. .. .	22.4	23.9	6.5	23.1
1956-57 .. .. .	23.6	25.0	5.8	24.0
1957-58 .. .. .	23.8	25.1	5.3	24.5
1958-59 .. .. .	25.7	26.2	1.9	26.0
1959-60 .. .. .	26.8	27.6	2.9	27.2

The index of variability in col. 5 is calculated as  $\frac{E_1 - E_2}{E_1} \times 100$  where  $E_1$  is the percentage estimate based on sub-sample I,  $E_2$  that based on sub-sample II and  $E_{12}$  is the combined estimate. There seems close agreement between the two sets of estimates for each of the five years from

1955-56 to 1959-60. The indices of variability are not high-varying from 1.9 in 1958-59 to 6.5 in 1955-56.

3.45. *Gross Unirrigated Area as Percentage to Gross Cropped Area.*—The figures of gross unirrigated area as percentage to gross cropped area as obtained from two sources namely, village records and household schedule, are presented in Table 3.26 for 1959-60.

TABLE 3.26

*Gross Unirrigated Area as a Percentage to the Gross Cropped Area for 1959-60, by Source of Data*

Sample areas in States	Household data	Village records
(1)	(2)	(3)
Andhra Pradesh .. .. .	53.0	59.6
Bihar .. .. .	69.2	67.2
Gujarat .. .. .	86.8	89.3
Kerala .. .. .	84.7	93.5
Madhya Pradesh .. .. .	85.8	86.4
Madras .. .. .	70.5	66.0
Maharashtra .. .. .	88.5	99.1
Mysore .. .. .	73.3	77.1
Orissa .. .. .	63.3	66.7
Punjab .. .. .	47.4	50.3
Rajasthan .. .. .	79.2	81.4
Uttar Pradesh .. .. .	48.7	69.6
West Bengal .. .. .	69.7	76.4
All States sample .. .. .	70.5	75.2

The percentage figures based on the household data and the village records show a close agreement.

3.46. *Intensity of Cropping.*—Statistics of the proportion of area sown more than once to net cultivated area as calculated from the data collected from the two levels, are given in Table 3.27.

TABLE 3.27

*Estimates of the Proportion to Net Cultivated Area of (a) Net Irrigated Area (b) Area Sown More Than Once (1955-56 and 1959-60)*

Sample areas in States	Percentage of net area irrigated				Percentage of area sown more than once			
	1955-56		1959-60		1955-56		1959-60	
	Household data	Village records	Household data	Village records	Household data	Village records	Household data	Village records
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Andhra Pradesh	41.1	32.1	41.3	34.4	29.1	23.6	35.9	26.4
Assam .. .. .	5.0	0.0	6.9	0.0	23.3	14.0	25.2	14.3
Bihar .. .. .	43.9	43.7	46.8	47.0	60.5	47.1	60.8	54.5
Gujarat .. .. .	11.8	7.4	14.4	9.4	9.3	9.9	9.7	9.2
Kerala .. .. .	16.1	6.2	16.1	7.1	19.8	39.2	19.2	39.1
Madhya Pradesh	11.3	8.8	14.0	15.5	17.1	15.9	17.6	17.8
Madras .. .. .	32.0	N.A.	22.2	17.3	15.5	N.A.	9.0	13.1

(Table—Contd.)



(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Maharashtra ..	5.4	5.7	9.4	8.5	7.2	2.0	3.0	5.1
Mysore ..	21.5	18.8	21.2	20.0	6.6	6.4	6.5	6.4
Orissa ..	38.1	37.5	38.3	37.7	3.2	6.6	3.9	15.6
Punjab ..	39.7	50.7	56.6	53.3	27.8	33.1	41.5	36.6
Rajasthan ..	19.1	25.1	18.6	19.4	3.1	2.5	3.9	7.0
Uttar Pradesh ..	47.6	40.2	47.0	35.1	14.4	29.1	14.2	27.9
West Bengal ..	31.2	29.5	39.2	27.9	14.2	17.7	15.2	24.6
All States sample	23.1	23.7	27.2	23.8	16.7	16.6	18.8	17.7

N.A.—Not Available.

In respect of coverage of net cultivated area by irrigation, the household data, as has been pointed out earlier, show a higher estimate. This is generally the case in all States except Bihar, Madhya Pradesh and Rajasthan; but even in the latter States the difference is relatively small. It should be noted that the figures of net irrigated area as per cent of net cultivated area in Table 3.27 have been shown for all works, major and minor and are not to be compared with those given in Table 3.24 where only minor works have been taken into account.

3.47. The estimates of intensity of cropping derived from the random sample of household and from the village records for the year 1955-56 are in close agreement for the entire sample taken together. As regards estimates for the States, the differences are very pronounced in Kerala and U.P. In both the cases, the figures based on village records are much higher. The difference between the two sets of data for the year 1959-60 is slightly higher for the sample as a whole. Among the States, again, the differences turns out to be maximum in Kerala followed by U.P. In both these States, the village data show a much higher level of cropping intensity than our household data. The measure of change in intensity of cropping estimated on the basis of household data thus turns out to be higher than that based on village records.

3.48. *Cropping Pattern.*—Statistics of the cropping pattern derived from the two sets of data—household and village level are presented in Table 3.28, along with figures of the index of variability between the sub-sample estimates of the random sample of households.

TABLE 3.28

*Comparison of Estimates of the Share of Important Crops in the Cropped Acreage for 1959-60 in the Sample Areas, derived from Village and Household Data*

Level	Percentage of cropped area under			
	Paddy	Wheat	Sugarcane	Cotton
(1)	(2)	(3)	(4)	(5)
Village records ..	21.6	9.5	1.9	5.9
Household random sample ..	20.8	11.5	2.8	4.0
Household knowledgeable ..	25.6	9.5	2.8	3.8
Index of variability ..	1.0	6.9	10.7	7.5

Paddy, wheat, sugarcane and cotton are the four crops for which the proportion to the gross cropped acreage could be tabulated. There appears

to be relatively close agreement between the percentage estimates derived from the village records and from the household schedules in the case of paddy. It is not so close in the case of other three crops—their magnitudes being, however, very small. It is important to note that the progressive farmers devoted relatively more of their cropped area to the cultivation of paddy than the other cultivators, and less to wheat. The index of variability for the sample estimate in the case of paddy is not high; but the same is not true for the other crops.



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## CHAPTER IV

### PROBLEMS OF UTILIZATION OF MINOR IRRIGATION FACILITIES

4.1. Our objective in the last chapter was to present a picture of the state of minor irrigation works, their growth during the last five years or so, and the nature of their impact on the use of irrigation water and on the cropping pattern. The main purpose in this discussion was to present a statistical picture that would serve as a background to the discussion of the various problems associated with minor irrigation. In this chapter we shall take up the general problems relating to the utilization or under-utilization of the potential created by the minor works. The problems that will be analysed in this chapter are the relationship of the nature and size of works to the degree of utilization of their potential, the adequacy of supply of water from the works, the reasons adduced by the cultivators for under-utilization, difficulties in changing the cropping pattern, the problems of field channels, water rates and of co-ordination of the major and minor sources of irrigation.

#### UTILIZATION OF THE POTENTIAL OF MINOR WORKS

4.2. We have discussed in Chapter III the extent of utilization of the irrigation potential of minor works with particular reference to tanks and wells. The position regarding the utilization of the irrigation potential of works of different types is summarised for the Kharif and the Rabi seasons of 1959-60 in Table 4.1. Details showing the position in different States are given in the Appendix Table C—21.

TABLE 4.1

*Proportion of Irrigable Area Irrigated in 1959-60 by Type of Works and Season*

Type of work	% of irrigable area irrigated (1959-60)	
	Kharif	Rabi
(1)	(2)	(3)
Tank .. .. .	94.8	97.4
Pucca well .. .. .	37.9	69.8
Kutchia well .. .. .	8.9	75.2
Tube-well .. .. .	30.7	38.7
Pump set .. .. .	39.7	36.0
Others .. .. .	45.5	73.6
All works .. .. .	45.9	69.7

The utilization of the potential of all minor works in the Kharif season of 1959-60 was about 46%, as compared to 70% in the Rabi season. The proportion of utilization was highest for tanks in both the seasons. It should be mentioned here that the relatively high figure of utilization for tanks in the Rabi season is largely accounted for by the manner in which the irrigable area has been calculated. In the absence of any definite figure of irrigable area for tanks in the Rabi season, we have followed the customary practice

of estimating the irrigable capacity of the tank in this season on the basis of the proportion of the actual Rabi to Kharif irrigation at the State level. This has naturally tended to raise the level of utilization by more or less equating the irrigable with the irrigated area. The variation in the extent of utilization among the States has been discussed in the last chapter and show that the problem is particularly acute in some States like Orissa.

4.3. Pucca wells and kutchas wells were utilized much more in the Rabi season than in the Kharif. But tube-wells and pump sets recorded a wide disparity in their degree of utilization between the two seasons. Other sources were used mainly for Rabi irrigation. The data tend to show that the problem of utilization of the potential is more acute in the case of tube-wells and pump sets in each of the two seasons than for other works. It may be noted in this connection that kutchas wells, even though they show the lowest degree of utilization in the Kharif season, are usually meant for irrigation in the dry season (Rabi). Secondly, even though in the Rabi season all the categories of works show relatively high rates of utilization, a certain proportion of their capacity still remains unutilized. In short, there is a degree of non-utilization even in minor works, though this problem is generally associated with the new major irrigation facilities.

#### SIZE OF WORKS AND UTILIZATION OF IRRIGATION POTENTIAL

4.4. *Size of Tanks and Degree of Utilization.*—Among the factors associated with the under-utilization of a particular work, size of work itself may be one. The higher the irrigable capacity of a work, the greater the chances of a portion of it being not required for irrigation by its owner and remaining under-utilized to that extent. The difficulty of lifting water, or of carrying it to fields at long distances from the work-site may result in lower utilization as the size of work increases. It is because of this hypothetical association that an attempt has been made by us to examine the extent of utilization in relation to the size of works. The analysis is confined only to tanks and wells. Table 4.2 gives the distribution of tanks according to their size of irrigable area and the proportion of their irrigable area actually irrigated in the Kharif and the Rabi seasons of 1959-60. The data relate to the sample villages in the four selected blocks of Andhra Pradesh. It should be added here that the irrigation potential has been taken to be the same in both Kharif and Rabi, for the purpose of this table.

TABLE 4.2

*Relationship between Size of Tanks and Extent of Utilization of their Irrigation Potential in 1959-60 in Andhra Pradesh*

Size of tank by irrigable area (acres)	Number of tanks	Percentage to total	% of irrigable area irrigated	
			Kharif	Rabi
(1)	(2)	(3)	(4)	(5)
0-01—12-50	31	37-4	97-4	3-2
12-51—25-00 .. ..	24	28-9	98-0	3-4
25-01—50-00	11	13-3	95-2	1-0
50-01—100-00	9	10-8	99-8	6-4
100-01—200-00	5	6-0	98-4	25-2
200-01—above .. ..	3	3-6	79-2	42-7
All tanks	83	100-0	93-8	18-3

The sample areas in Andhra have been selected for this analysis for two reasons. First, the use of data for one area would eliminate regional variations as far as possible. Secondly, the sample areas in Andhra had the largest number of tanks, 93 out of 257 in the whole sample. Coming to the data in Table 4.2 they do not show any inverse relationship between the size and the extent of utilization in the Kharif season, except for tanks with irrigable area above 200 acres. But, in the Rabi season, the utilization as a proportion of the overall potential show a tendency to go up with the irrigable area of tanks from the size of 50 acres and above. This may be due to the large storage capacity of bigger tanks, which helps in retaining water for a longer period, particularly in deeper tanks, and reduces evaporation losses. The larger tanks may also be designed relatively more for Rabi irrigation than the smaller ones. The relationship of size with the extent of utilization in Rabi would have been more meaningful if there had been independent, accurate estimates of the irrigable area in the Rabi season. Normally, if the major portion of the tank water is utilized for Kharif irrigation, then in the absence of any replenishment later in the year, the extent of irrigation in the Rabi will be lower than that in the Kharif.

4.5. *Utilization and Size of Pucca Wells.*—From the data on pucca wells in the sample villages of four selected blocks in Bihar and two in Gujarat, the distribution of wells by size expressed in terms of irrigable area and for each size-group the percentage of irrigable area actually irrigated, in the Kharif and Rabi seasons of 1959–60 has been worked out. These data are presented in Table 4.3.

TABLE 4.3

*Relationship between Size of Pucca Wells and Extent of Utilization of Their Irrigation Potential*

Size of wells by irrigable area (acres)	Bihar blocks				Gujarat blocks			
	Wells		% irrigable area irrigated		Wells		% irrigable area irrigated	
	No.	%	Kharif	Rabi	No.	%	Kharif	Rabi
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
0 — 2.50	13	26.6	—	88.4	8	30.8	79.3	89.6
2.51— 5.00	10	20.4	2.8	72.9	9	34.6	89.0	31.5
5.01— 7.50	7	14.3	8.3	84.5	5	19.2	80.0	43.3
7.51— 10.00	18	36.7	—	83.3	2	7.7	75.0	15.0
10.01—Above	1	2.0	—	11.4	2	7.7	100.0	14.3
All wells	49	100.0	1.4	74.8	26	100.0	86.8	33.5

Data in Table 4.3 relate to pucca wells and only those among the pucca wells for the construction of which financial assistance was received from the Government; details for other wells were not available. These data show that in Gujarat, irrigation from pucca wells is done mainly in the Kharif season though it is not meagre in the Rabi. On the other hand, wells in Bihar are utilized practically in the Rabi season only.

#### PROBLEMS AND DIFFICULTIES IN THE WAY OF FULL UTILIZATION

4.6. *Tanks.*—Of the 245 tanks in the sample, 47 or nearly one-fifth were reported to be not fully utilized. Table 4.4 gives data showing the distribution of these under-utilized tanks according to the causes or reasons given for this condition.

TABLE 4.4

*Distribution of Under-utilized Tanks by Reasons for Under-utilization*

Reason for under-utilization	No. of tanks	%
(1)	(2)	(3)
I. <i>Locational Factor</i> .. .. .	9	19.1
1. Not necessary due to adequate rainfall .. .. .	2	4.2
2. Works located close to one another .. .. .	7	14.9
II. <i>Physical Condition of Tanks</i> .. .. .	22	46.9
1. Loss of water due to delay in urgent repairs on breaches .. .. .	10	21.4
2. Inadequate weirs, water flow not regulated due to kutchha outlets .. .. .	2	4.2
3. Lifting device not installed or lifting of water costly .. .. .	10	21.3
III. <i>Economic Condition of Cultivators</i> .. .. .		
1. Financial resources inadequate for hiring pump sets or installing lifting devices .. .. .	2	4.2
IV. <i>Others</i> .. .. .	3	6.3
1. Irrigable land left fallow for threshing floor .. .. .	1	2.1
2. Irrigation not allowed to others .. .. .	2	4.2
V. <i>Reason Not Given</i> .. .. .	11	23.5
TOTAL .. .. .	47	100.00

It appears from the data given in Table 4.4 that the under-utilization of tanks is caused very largely by their physical condition, the locational disadvantages or difficulties coming next in order of importance. Financial reasons seem to play a very small part in this matter. Among the locational factors which together account for about 19% of the tanks, their close location is the most important. This factor was the main reason for under-utilization noticed in Bihar. As has already been pointed out, physical condition of the tanks has been reported as the reason for under-utilization of 47% of the tanks. Most of these tanks are located in Andhra and Uttar Pradesh. Nearly 21% of the tanks were found to be losing water because of delay in urgent repairs on breaches that had occurred earlier. Consequently these were not in a position to achieve their full potential. In another 4% of the tanks, water was going waste because of the inadequate or unsound nature of the weirs or outlets. Thus there was wastage of water in about one-fourth of the tanks; and this wastage stood in the way of achievement of the full potential. In another 21% either the lifting devices were not installed or the lifting of water was considered too costly. The other reasons given for under-utilization are, though important in themselves in some of the areas, are not of a sufficiently general nature. It may be added that not only was the current irrigation potential of these tanks under-utilized but the potential of nearly one-half of the tanks was also found to have gone down over the years as a result of silting and poor maintenance.

4.7. *Wells*.—For wells, the reasons or causes of under-utilization have been ascertained from the sample respondents who reported to have under-utilized wells. Table 4.5. gives the distribution of responses obtained from

the cultivators in the random sample as well as in the knowledgeable persons' sample.

TABLE 4.5

*Number and Percentage of Respondents Reporting Under-utilized Wells according to Reasons for Under-utilization*

Reasons for under-utilization	Random		Knowledgeable	
	No.	%	No.	%
(1)	(2)	(3)	(4)	(5)
<b>I. Locational Factor</b>				
A. Water not needed	94	50.2	65	39.6
1. Kharif irrigation not needed	11	5.9	10	6.1
2. Capacity of work more than needed by owner	33	17.6	26	15.9
3. No demand for water by others	24	12.8	15	9.1
4. Irrigation source located close to one another	26	13.9	14	8.5
B. Water needed but cannot be utilized fully	28	15.0	21	12.8
1. High and uneven land	17	9.1	16	9.8
2. Land located outside irrigable area	11	5.9	5	3.0
<b>II. Physical Condition of Well</b>	16	8.6	12	7.3
1. Water level low, flow unsatisfactory	11	5.9	9	5.5
2. Salinity of water	5	2.7	3	1.8
<b>III. Economic Condition of Cultivators</b>	26	13.9	35	21.4
1. Lack of finance	10	5.3	16	9.8
2. Lack of bullock power	11	5.9	3	1.8
3. Well irrigation costly	5	2.7	16	9.8
<b>IV. Others</b>	23	12.3	31	18.9
1. Power shortage	2	1.1	5	3.0
2. Shortage of manure	3	1.6	7	4.3
3. Unwillingness of owners to share water with others	11	5.9	7	4.3
4. Miscellaneous	7	3.7	12	7.3
<b>TOTAL</b>	187	100.0	164	100.0

Table 4.5 reveals that the locational factor is the most important one for the under-utilization of wells. This has been reported in some form or other by 65% of the cultivators in the random sample and 52% of those in the knowledgeable persons' sample. Next in importance are factors related to the economic condition of the cultivators. These were put forward by about 14% of the cultivators and 21% of the knowledgeable persons. Poor physical condition of the wells was another important factor.

4.8. The reasons for the under-utilization of wells are very different from those for tanks. Location and the need of water play a very important part in the case of dispersed works of a small size, like wells. The data in Table 4.5 tend to show that about one-half of the respondent cultivators did not need, at least, a part of the water in their wells. Surprisingly enough, numerically the most important reason given for the lack of a need for the water was that the capacity of the work was larger than the needs of the owner. This should be combined also with another reason given by them, namely, that there was no demand for water by others. Both of these tend to show over-capitalisation in the economic sense and the existence of surplus capacity. Another important factor, mentioned about 14% of the cultivators relates to the unsatisfactory planning of the location of wells. If wells are

located close to one another, it is quite natural that the full capacity of each will not be utilized. On the whole 65% of the cultivators in the random sample and 52% of those in the knowledgeable persons' sample ascribed under-utilization to some reason or other connected with the location of the wells. Another 14 and 21% respectively of the two samples mentioned as reasons, the economic condition of the cultivators, which seems to play a more important part in utilization of well water than in that of tanks. The difficulties mentioned are lack of finance, lack of bullock power, and another related one, namely, that well irrigation is costly. Other important reasons are related to the unsatisfactory siting of the wells, unwillingness of owners to share water with the others, and the poor physical condition of the wells caused largely by low water table and salinity. In general, the reasons for under-utilization of wells, diverse though these are, can be broadly grouped into four categories. In the first place, there seems to have been a building up of surplus capacity of well irrigation on the part of some of the cultivators. Secondly, the cultivators seem to think that the location and spacing of the wells in relation to the land to be irrigated have been such that in certain areas at least some of the plots did not receive water from the works. In certain other cases, the topography of the land itself stood in the way of extension of the irrigation from the existing works. Topography is, however, beyond the control of the cultivators particularly when the works have to be located at the sites where water will be available. Topographical limitations apart, the extent to which the spacing and location difficulties have been reported to cause under-utilization of the water, implies that a different pattern of spacing of the existing wells would have covered a larger area with irrigation. Thirdly, the economic condition of cultivators is also a factor standing in the way of a fuller utilization of well water. Finally, there is also under-utilization resulting from the lack of need for irrigation in the Kharif season. There are other factors not to be neglected in this connection, for example, the unwillingness of the owners of wells, in some cases, to share the water with the others.

4.9. A point that needs to be specially noted in connection with the irrigable capacity of wells and its utilization is the part that pump sets play in this matter. It has been noted in the last chapter that pump sets have increased in number at a phenomenal rate since 1955-56, and that the degree of under-utilization of their capacity is the highest among the minor facilities. Reports from many of our sample areas indicate that pump sets, usually recommended for technical reasons, are those which have a minimum capacity of 5 h.p., whereas the actual irrigational needs of many cultivators can be met by pumps of smaller capacity. A large proportion of these pump sets is being purchased with loans made available from the block funds. This is also true of some of the private tube-wells in many areas. The discrepancy between the capacity of the works and the actual needs of the farmers is tending to create some degree of over-capitalisation and surplus irrigational capacity on the farms. Such over-capitalisation is not necessarily related to the total size of holdings, but also, and more so, to the dispersal and scatter of the fragments in the holding.

#### ADEQUACY OF SUPPLY OF IRRIGATION WATER

4.10. From the fact that there are minor works which are under-utilized, one should not conclude that there is no demand for irrigation water, or that irrigation facilities are considered adequate by the cultivators. During the



course of the enquiry, the respondents were asked if they had a supply of water to irrigate as much land as they would like to. Of 1,255 respondents in the random sample of cultivators and 702 in the knowledgeable persons' sample, about 78.5% in each group replied that "they did not get enough irrigation water" (Table 4.7). The proportion of persons not getting enough water for irrigation was highest in the selected blocks in Orissa and was three-fourths or more in the sample from all States except U.P., Maharashtra and Punjab. Table 4.6 gives reasons for not getting enough water for irrigation.

TABLE 4.6

*Distribution of Responses of Cultivators in the Random and Knowledgeable Samples, by Reasons for Not Getting Enough Water for Irrigation*

Reason	Responses			
	Random		Knowledgeable	
	No.	%	No.	%
(1)	(2)	(3)	(4)	(5)
I. Locational Factor	416	43.9	252	42.0
1. Plots outside irrigable area	332	35.1	202	33.6
2. No source of water	71	7.5	43	7.2
3. Wrong location of outlet	9	0.9	4	0.7
4. High level of plots	4	0.4	3	0.5
II. Physical Condition of Works	420	44.4	290	48.2
1. Shortage of water in irrigation works	384	40.6	277	46.0
2. Appearance of rock in wells	13	1.4	3	0.5
3. Want of pucca bund and channels	7	0.7	6	1.0
4. Water level very low	11	1.2	1	0.2
5. Irregular Maintenance	5	0.5	3	0.5
III. Economic Condition of Cultivators	112	11.7	59	9.8
1. Lack of bullock power	5	0.5	5	0.8
2. High water charges	22	2.3	9	1.5
IV. Others				
1. Irregular supply of water	57	6.0	23	3.8
2. Unfair distribution of water	4	0.4	3	0.5
3. Miscellaneous	24	2.5	19	3.2
TOTAL	948	100.0	601	100.0

The most important problem reported by the farmers was shortage of water in the works. Silting, bad state of repairs, neglect in maintenance, lack of boring facilities, failure of rains, etc., had contributed to the reduction in their capacity. Another factor which comes out strongly is the location of the plots in relation to the irrigable area of the minor works. Nearly 35% of the responses of cultivators in the random sample group and 34% in the knowledgeable group indicated that their plots were outside the irrigable area. A considerable proportion of the respondents was handicapped by not having within their reach any irrigation work. Most of these respondents were from Rajasthan, Orissa, Assam, and Madhya Pradesh. These responses show that there were minor irrigation works close to their holdings but not available for irrigation of their desired plots. It is interesting to note, as will be evident from Table 4.7 that the respondents in some of these States, at least, did not report the non-existence or shortage of sources.

of supply as a reason for the inadequacy of water. Both these factors taken together seem to indicate the importance of location and spacing of the existing works as has been noted in the last paragraph.

4.11. The data given in Table 4.6 show a very high concentration of the reasons for the inadequate supply on three factors, shortage of irrigation water in the works, plots or fields outside the command area of the works and the non-existence of sources of supply. An attempt has been made to further analyse these reasons in order to obtain an idea of the areas where these are important factors. Table 4.7 presents data on proportion of respondents in each State indicating that they were not getting enough water and the distribution of their responses among the factors stated above. It appears that the proportion of respondents in the cultivators' sample as well as in the knowledgeable persons' sample, reporting inadequacy of water supply was more or less uniformly high in nearly all the States. The proportion of the cultivator respondents was about 75% in every State, except Maharashtra and U.P. It was only in U.P. that the proportion was relatively low, being 43% of the cultivators and 47% of the knowledgeable persons. It should also be noted that the nature of responses in each State does not indicate any significant difference between the assessments of the cultivators and those made by the knowledgeable persons.

4.12. The three main reasons reported for the inadequacy of water supply show, however, a divergent pattern of distribution among the States. Shortage of water in the works comes out as relatively the most important reason in Andhra, Gujarat, Kerala, Madras, Maharashtra, Mysore, and U.P. This was, however, one of the least important reasons in Punjab, Assam and Rajasthan. Inadequacy of supply of irrigation water owing to the fields not being located within the command of the works was reported to be the most important of these factors in Assam, Orissa and Rajasthan. It was also as important as any other reason in Bihar and Madhya Pradesh, but was not considered to be a reason of any importance in Gujarat, Kerala, Maharashtra and Punjab and to a certain extent, in West Bengal. Non-existence of any minor source of supply of irrigation water was the most important of the reported reasons in West Bengal and Kerala. The only other State where this reason was reported to be of any significant importance is Bihar. The position in the different States in regard to the main reasons for the inadequate supply of water may now be briefly summarised. West Bengal, Kerala and to some extent, Bihar are the areas where non-existence of irrigational source is very largely the reason for the reported inadequacy in the supply of water. Assam, Madhya Pradesh, Orissa, Rajasthan, and, to a certain extent, Madras are the areas where location of the irrigation works in relation to the fields of the cultivators is a very important reason for the inadequate availability of water by the respondents. This factor, however, has been reported in varying proportions by the respondents in all the States except Gujarat, Kerala, Punjab, Maharashtra and to some extent, West Bengal. In all the States except Punjab and Assam, and to some extent Rajasthan, shortage of water in the works seems to be the most important reason for the inadequate supply of water reported by the respondents. Inadequate and irregular maintenance of the irrigation works emerge, therefore, as the most important factor in many of the States for the shortage of irrigation water reported by the respondents.

4.13. *Nature of Inadequacy of Water Supply.*—Supply of irrigation water can be considered inadequate either when the cultivator wants to

TABLE 4.7  
Proportion of Respondents Reporting Inadequate Supply of Irrigation Water  
and Distribution of Responses Regarding Reasons

Sample areas in State	Total no. of respondents	% of respondents not getting enough water			Shortage of water in the works			% of respondents not getting enough water in each State, offering as reason		
		Random Knowledge-able			Random Knowledge-able			Field not within the command area		
		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Andhra Pradesh	119	72	81.9	81.9	67.0	70.3	30.4	28.4	—	—
Assam	58	16	75.9	68.8	13.0	—	47.8	33.3	—	—
Bihar	120	66	81.7	71.2	25.7	18.9	21.0	25.3	18.0	20.0
Gujarat	60	36	83.3	75.0	69.0	95.2	—	—	—	4.8
Kerala	60	36	80.0	83.3	50.0	78.3	—	—	50.0	21.7
Madhya Pradesh	180	87	83.3	87.4	44.0	55.6	46.3	33.3	—	—
Madras	60	36	76.7	83.3	60.0	63.6	40.0	36.4	—	—
Maharashtra	60	36	61.7	63.9	55.6	50.0	11.1	25.0	—	—
Mysore	60	36	90.0	91.7	68.6	71.4	29.4	24.2	2.0	—
Orissa	58	36	100.0	100.0	37.3	46.2	61.4	50.8	—	—
Punjab	60	33	70.0	72.7	2.4	—	—	4.8	2.4	—
Rajasthan	120	68	87.5	91.2	15.4	16.4	72.1	83.6	1.9	—
Uttar Pradesh	120	72	43.3	47.2	53.1	43.5	37.5	41.3	—	—
West Bengal	120	72	76.7	81.9	34.3	48.8	11.9	4.9	47.8	43.9
All States sample	1255	702	78.5	78.4	40.5	46.1	35.0	33.6	7.5	7.2

irrigate lands which were previously unirrigated, or when the full water requirement of even the currently irrigated lands is not being met. As many as 54 per cent of the cultivators in the random sample group and 62 per cent in the knowledgeable group reported that they did not get water in adequate quantity to meet the full needs of their currently irrigated lands. It appears that the availability of water from the minor sources is not considered sufficient even for lands enjoying irrigation facilities from them by a fairly high proportion of the cultivators. The maximum numbers reporting inadequacy of water for distribution to the presently irrigated land have been found in the selected blocks of Orissa. Substantial numbers had a similar problem in a few blocks particularly in Shahpur (Sahabad) of Bihar, Deoband (Saharanpur) of U.P., Kotabommali (Srikakulam) of Andhra, Kamuthy (Ramnad) of Madras and Sawai Madhopur of Rajasthan.

#### CULTIVATORS' SUGGESTIONS FOR THE REMOVAL OF THE DIFFICULTIES IN THE SUPPLY OF WATER

4.14. During the course of enquiry the respondent cultivators were invited to offer suggestions about the way the problem of inadequate water supply for irrigation could be solved. Table 4.8 gives separately the number and percentage of the different responses obtained from the persons in the random sample and in the knowledgeable sample.

TABLE 4.8

*Distribution of Responses Showing Suggestions for Removing the Inadequacy of Supply of Irrigation Water, as Given by the Cultivators and the Knowledgeable Persons*

Suggestions	Responses			
	Random		Knowledgeable	
	No.	%	No.	%
(1)	(2)	(3)	(4)	(5)
I. <i>Construction of New Works</i>	144	27.3	103	28.8
1. Construction of pucca wells	74	14.0	41	11.5
2. Installation of State tube-wells	58	11.0	37	10.3
3. Construction of new tanks, new tanks at higher levels, reservoirs, ahars, pynes etc.	12	2.3	25	7.0
II. <i>Reconstruction and Renovation of Existing Works</i>	297	56.2	185	51.7
1. Increasing the capacity of works through deepening/desilting of tanks and wells	215	40.7	140	39.1
2. Reconstruction of wells—blasting operation in wells	15	2.8	7	2.0
3. Construction of pucca channels, bunds, etc.	57	10.8	29	8.1
4. Provision of gates, culverts and regulators for tanks	10	1.9	9	2.5
III. <i>Repairs, Maintenance etc.</i>	27	5.1	7	2.0
1. Supply of spare parts of oil engines etc.	18	3.4	1	0.3
2. Proper maintenance of works	9	1.7	6	1.7

(Table—Contd.)

	(1)	(2)	(3)	(4)	(5)
IV. <i>Distribution of Water etc.</i> ..		60	11.4	63	17.5
1. Supply of water throughout the year		21	4.0	8	2.2
2. Fair distribution of water ..		16	3.0	23	6.4
3. Miscellaneous .. ..		23	4.4	32	8.9

The data in Table 4.8 reveal that the majority of the suggestions, 56% of those given by the cultivators and 52% by the knowledgeable persons, related to the reconstruction, renovation and improvement of the existing works. Suggestions to solve the problem of inadequacy of water supply through the construction of new works formed only 27% and 29% of the responses given by the cultivators in the two respective samples. Suggestions designed to improve the repair and maintenance aspects and to enforce better methods of distribution of water accounted for the remaining 17 to 20% of the responses in the two groups.

4.15. Irrespective of these classifications, the order of importance of the different suggestions show the following pattern. The suggestion that accounted for the highest proportion of responses was to increase the capacity of works through the deepening or desilting of tanks and wells or through the reborings of wells. Next in order of importance was the suggestion for the construction of pucca wells, followed by those for the installation of State tube-wells and the construction of pucca channels and bunds. These four suggestions which have tended to follow the local conditions, accounted for 69 to 77% of responses. Suggestions for increasing the capacity of works have been received from the sample respondents in all the areas, but they relate to tanks in the tank areas and to wells in the well areas. Construction of pucca wells has been suggested mainly from Mysore, U.P., Bihar and Gujarat. State tube-wells have come as a suggestion mostly from the Nagal and Deoband blocks of Saharanpur, Uttar Pradesh and Sheosagar and Shahpur blocks of Shahabad in Bihar. On the whole, therefore, the sample cultivators seemed more concerned to have the problem of inadequacy of irrigation water from minor works solved through measures for the improvement, renovation and reconstruction of the existing works, improvement in their repair and maintenance and changes in the system of distribution of water, than through the construction of new works like wells, tanks, tube-wells etc.

#### ENFORCEMENT OF PRESCRIBED CROPPING PATTERN

4.16. Under-utilization of the irrigation potential created by the major projects is known to result when the farmers' preferences in respect of the cropping pattern turn out to be different from what the irrigation authorities have assumed in their design and system of distribution of water. Such divergences and conflicts delay the process of changeover to wet farming. As regards minor works, this factor is not generally important, except in the case of big tanks and bandharas. Information on such a divergence between the views of the irrigation authorities and the preferences of the cultivators in respect of the cropping pattern has been reported from our sample areas in Maharashtra. The cropping pattern generally recommended by the Irrigation Department for the newly irrigated areas (from larger works) in Maharashtra is as follows :

Rabi crops	31%
Kharif crops	27%
Eight-month crops	16%
Hot weather crops	8%
Perennial crops	18%

The cultivators' preferences in the matter of irrigation of crops follow, however, a different order, as shown below:

1. Perennial crops, generally sugarcane;
2. Eight-month crops, vegetables, chillies, etc.
3. Wheat and Rabi jowar;
4. Kharif crops.

Thus, the Kharif crops are given a very low priority by the cultivators in the scale of their preferences, while these are placed very high in the scale prescribed by the Irrigation Department.

4.17. The divergence of views in respect of cropping pattern, between the Government and the cultivators seems to arise because of serious differences in the approach of the two parties. Generally speaking, financial returns from the receipt of water charges appear to be a very weighty consideration with the irrigation authorities. The cultivators, however, go by the relative economics of different crops and their assessment of the costs and benefits to be derived from irrigation over a period.

#### INADEQUACY OF WATER AS AFFECTING IRRIGATION OF DIFFERENT CROPS

4.18. In view of such divergent views, it will be worthwhile to examine the reaction of those cultivators who reported inadequacy of water for the purpose of extending irrigation. These cultivator-respondents were asked to specify the particular crops that they were unable to irrigate because of inadequate supply of water. Table 4.9 gives data on the distribution of these respondents according to the crops they could not irrigate owing to the inadequate supply of water.

TABLE 4.9

*Distribution of Respondents Reporting Inadequate Supply of Water, According to Crops they could not Irrigate*

Crops	Respondents			
	Random		Knowledgeable	
	No.	%	No.	%
(1)	(2)	(3)	(4)	(5)
Paddy .. .. .	341	34.6	234	42.5
Wheat .. .. .	209	21.2	121	22.0
Pulses .. .. .	68	6.9	48	8.7
Cotton .. .. .	71	7.2	40	7.2
Sugarcane .. .. .	47	4.8	34	6.2
Maize .. .. .	47	4.8	26	4.7
Barley .. .. .	44	4.5	21	3.8
Other millets .. .. .	40	4.0	27	4.9
Oilseeds .. .. .	20	2.0	14	2.5
Potato .. .. .	7	0.7	15	2.7

(Table—Contd.)

	(1)	(2)	(3)	(4)	(5)
Jute .. .. .	8	0.8	5	0.9	
Groundnut .. .. .	5	0.5	4	0.7	
Vegetables .. .. .	12	1.2	13	2.4	
Others .. .. .	3	0.3	8	1.4	
No. not getting enough water .. ..	985		551		

It appears that the inadequate supply of irrigation water had affected the irrigation of different crops not to the same extent. The crops that the largest proportion of the respondents would have irrigated but could not do so were paddy and wheat. 35% of the cultivators in the random sample and 43% of those in the knowledgeable sample were unable to irrigate paddy though they wanted to, while 21% and 22% of the respondents in the respective samples failed to irrigate wheat in spite of their desire. Cotton, pulses and sugarcane were among the other crops that also suffered in this respect.

4.19. An attempt has also been made to find out the location of the sample areas where difficulties in the irrigation of paddy and wheat crops on account of inadequate supply of water had been largely reported by the respondents. The distribution of respondents reporting such a difficulty among the sample areas in different States is given in Table 4.10.

TABLE 4.10.

*Distribution of Respondents Reporting Inadequate Supply of Water and Inability to Irrigate Paddy and Wheat by State*

Sample areas in States	Respondents not getting enough water		Per cent unable to irrigate			
	Random (No.)	Known-geable (No.)	Paddy		Wheat	
			Random	Known-geable	Random	Known-geable
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Andhra Pradesh ..	109	59	54.1	67.8	—	—
Assam .. .. .	44	11	2.3	—	—	—
Bihar .. .. .	98	47	73.5	85.1	79.6	100.0
Gujarat .. .. .	50	27	18.0	11.1	2.0	3.7
Kerala .. .. .	48	30	8.3	43.3	—	—
Madhya Pradesh ..	150	76	25.3	30.3	41.3	32.9
Madras .. .. .	46	30	54.3	66.7	—	—
Maharashtra .. ..	37	23	8.1	13.1	16.2	21.7
Mysore .. .. .	54	33	33.3	48.5	—	—
Orissa .. .. .	58	36	82.8	88.9	—	—
Punjab .. .. .	42	24	—	—	31.0	29.2
Rajasthan .. .. .	105	62	—	—	19.0	25.8
Uttar Pradesh .. ..	52	34	30.8	32.4	55.8	58.8
West Bengal .. ..	92	59	52.2	55.9	—	—
All States sample ..	985	551	34.6	42.5	21.2	22.0

In respect of the paddy crop, the largest proportion of respondents reporting inability to irrigate on account of inadequacy of the supply of water,

was found in the sample areas in Orissa. The other States where this difficulty was reported to a large extent are Bihar, Andhra Pradesh, Madras and West Bengal. In these States, more than 50% of the respondents, not getting an adequate supply of water reported their inability to irrigate the paddy crop. Inadequacy of water for irrigated paddy was also reported to an appreciable extent by the respondents in Madhya Pradesh, Mysore and U.P. As regards wheat, the proportion of respondents who could not irrigate this crop on account of inadequate supply of water was highest in Bihar. The other States in order of importance are U.P., M.P. and Punjab. This difficulty was also reported from Maharashtra and Rajasthan. Significantly enough, in most of the States, the knowledgeable cultivators recorded a higher proportion of such inability to irrigate than the cultivators in the random sample.

4.20. *Inadequacy of Irrigation as Affecting the Introduction of New Crops.*—Shortage or lack of irrigation water can affect farming practices in another way. A new crop which would have been otherwise introduced might not be grown at all. Table 4.11 gives data on the number and proportion of respondents who were desirous of introducing different crops but could not do so on account of shortage of irrigation water.

TABLE 4.11  
*Distribution of Respondents Reporting Inadequate Supply of Water and Inability to Introduce New Crops.*

Crop	Respondents			
	Random No.	%	Knowledgeable No.	%
(1)	(2)	(3)	(4)	(5)
Sugarcane .. .. .	158	16.0	98	17.8
Paddy .. .. .	104	10.6	49	8.9
Potato .. .. .	65	6.6	47	8.5
Cotton .. .. .	24	2.4	13	2.4
Wheat .. .. .	23	2.3	11	2.0
Jute .. .. .	19	1.9	6	1.1
Tobacco .. .. .	9	0.9	6	1.1
Millet .. .. .	6	0.6	8	1.4
Oilseeds .. .. .	6	0.6	7	1.3
Pulses .. .. .	6	0.6	6	1.1
Vegetables .. .. .	125	12.7	85	15.4
Fruits .. .. .	15	1.5	6	1.1
Others .. .. .	31	3.1	35	6.4
TOTAL .. .. .	591	59.8	377	68.5
Total number not getting enough water ..	985		551	

Of the cultivators reporting inadequate supply of water, about 60% of those in the random sample and 69% of those in the knowledgeable sample would have introduced some new crop if there had been enough water. The highest proportion of the respondents were interested in starting the cultivation of sugarcane. Vegetables was the crop next in importance. Potato, cotton and jute among the 'cash' crops and paddy and wheat among the foodgrains were the other crops that suffered in this respect.

4.21. The State-wise distribution of the respondents who indicated their desire to introduce new crops but failed to do so on account of inadequate supply of water is given in Table 4.12, for the three most preferred crops, paddy, sugarcane, and vegetables.



TABLE 4.12  
*Distribution of Respondents Reporting Inadequate Supply of Water and  
 Inability to Introduce New Crops by State*

Sample areas in States	Respondents not getting enough water				Per cent desiring introduction of							
					Paddy				Sugarcane			
	Random (No.)	Knowledge- able (No.)	Random	Knowledge- able	Random	Knowledge- able	Random	Knowledge- able	Random	Knowledge- able	Random	Knowledge- able
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Andhra Pradesh	109	59	17.4	—	7.3	40.7	—	—	—	—	—	—
Assam	44	11	—	—	—	—	—	—	51.0	—	53.2	—
Bihar	98	47	13.3	10.6	37.8	31.9	4.0	—	4.0	—	—	—
Gujarat	50	27	4.0	—	40.0	33.3	—	—	—	—	—	—
Kerala	48	30	—	3.3	—	6.6	16.0	—	16.0	—	23.7	—
Madhya Pradesh	150	76	—	—	14.04	—	—	—	—	—	—	—
Madras	46	30	32.6	30.0	—	—	—	—	5.4	—	8.7	—
Maharashtra	37	23	—	—	—	4.3	—	—	—	—	—	—
Mysore	54	33	5.6	6.1	50.0	42.4	—	—	3.4	—	16.7	—
Orissa	58	36	19.0	13.9	5.2	30.6	—	—	9.5	—	16.7	—
Punjab	42	24	33.3	12.5	—	—	—	—	8.6	—	9.7	—
Rajasthan	105	62	6.7	9.7	20.0	12.9	—	—	5.8	—	5.9	—
Uttar Pradesh	52	34	—	2.9	5.8	15.2	—	—	31.5	—	37.3	—
West Bengal	92	59	21.7	28.8	19.6	17.8	—	—	12.7	—	—	—
All States sample	985	551	10.6	8.9	16.0	—	—	—	—	—	—	—

It appears that paddy would have been introduced by about 33% of the respondents complaining of inadequate supply of water in Madras and Punjab. The corresponding proportions for the respondents in West Bengal, Orissa, Andhra and Bihar were 22, 19, 17 and 13 per cent respectively. As regards sugarcane, the highest proportion of the cultivators in the random sample desirous of introducing it was recorded in Mysore (50%), followed by those in Gujarat (40%), Bihar (38%), West Bengal and Rajasthan (20%). The responses in respect of vegetables indicate the highest proportion, 51% in Bihar, followed by 32% in West Bengal and 16% in M.P. The responses of the knowledgeable cultivators in respect of these three crops more or less, show the same pattern of State-wise distribution. These responses do give us some idea, howsoever approximate it may be, of the direction in which changes in the cropping pattern may take place through the introduction of new crops on the holdings of cultivators, as they receive more of irrigation.

#### FIELD CHANNELS AND PREPARATION OF LAND

4.22. Field channels need to be constructed in good time and to an adequate length in order that irrigation water can reach the plots of each cultivator as soon as the main works are completed. This is true not only in the case of major projects but also of tube-wells, power pumps and works like big storage tanks, diversion weirs, bandharas etc. Non-construction of field channels in time and in sufficient length from such works affects the full utilization of their potential. An attempt was made by us to find out from the cultivator respondents if there was any lag in the construction of field channels, if they considered the channels already constructed satisfactory, and if they faced any difficulties in their construction. The position regarding field channels for State tube-wells will be discussed in detail in Chapter VIII where the problems and difficulties of State tube-wells will be analysed. In this section, we shall be concerned mainly with field channels for irrigation from tanks and other sources.

4.23. *Lag in the Construction of Field Channels.*—Field channels for carrying water to the plots are important in the case of tank irrigation. But no time-lag was reported by the respondents in the sample from Kerala and Andhra. In Rajasthan, however, the time-lag between the creation of irrigation potential and the construction of water courses has been reported to be largely responsible for the under-utilization of the large tanks.

4.24. *Condition of Field Channels.*—Of the 43 respondents in the random sample who specifically reported on the condition of field channels for tank irrigation, 67% were satisfied with the condition of these. The corresponding proportion in the sample of knowledgeable persons was 70%. Thus, more than two-thirds of the respondents considered the condition of channels satisfactory.

4.25. *Difficulties in the Construction of Field Channels.*—Difficulties in the construction of field channels for irrigation from tanks have been reported only from Andhra. The main obstacle there seems to be the lack of cooperation from fellow cultivators over or across whose fields the channels have to pass. Inadequate finance is another important difficulty reported by the cultivators. In Kapili (Nowgong) where power pump

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irrigation has been introduced, the need of financial assistance for constructing pucca channels has been specially emphasized by the respondents.

4.26. *Levelling of Land*.—Mention may be made of two other problems that stand in the way of fuller utilization of irrigation potential. These are inadequate levelling of fields and insecurity of land tenure. Levelling of land in the fields is particularly important in areas like Maharashtra. The Local Irrigation Committees in Maharashtra were expected to exert pressure on cultivators with unlevelled lands and to control the quantity of water issued to them. But these committees do not seem to have achieved much so far. They have not proved very effective in influencing the cultivators either in the proper maintenance of the field channels or in the proper levelling of fields or in the settlement of disputes arising out of water distribution.

4.27. *Land Tenure*.—Insecurity of land tenure has been reported in this connection as an important factor in Rajasthan. One of the main reasons for the under-utilization of the potential of tanks in Rajasthan is that allottees have not been forthcoming to take possession of the cultivable lands in the command areas of large tanks. Such allotment is of temporary tenure; and the period of allotment was previously three years. Recently though it has been raised to five years, the allotment does not seem to have been attractive to the allottees. Making such allotments for a longer period may, however, solve this problem.

#### WATER RATES

4.28. High water rates act as a disincentive in the matter of extension of irrigation and thus contribute to the under-utilization of the potential of the created works. This is generally true not only in the case of canals and tube-wells, but also of Government tanks. The level of the rate apart, there is another aspect having a bearing on the utilization of the water. This relates to the compulsory, optional or contractual nature of the agreement between the cultivator and the Government. Generally speaking, the optional or contractual system tends to result in a larger degree of under-utilization of irrigation in areas where rainfall is high. For example, the water from irrigation works like embankments, diversion weirs, etc. is supplied to the cultivators in West Bengal under the lease system provided in the Bengal Irrigation Act, 1876. Under this system, the cultivators desiring to have irrigation have to execute a bond each time, binding them to pay water charges. They normally wait for the rainfall; and only after it fails, they approach the Irrigation Department for executing the lease bond. Often it becomes too late. Neither the supply of water can be regulated properly in such times, nor the entire irrigable area can be covered adequately and in time. On the other hand, when rainfall is timely, the work remains under-utilized. In southern States like Madras, however, the water rate for tank irrigation is compulsory and obligatory. This system may be responsible, at least, partly for the high degree of utilization of the potential of the tanks in States like Madras. Even in these States, however, the levying of compulsory water rates on the ex-zamin tanks taken over by the Government as a result of the land reforms, is presenting a problem.

4.29. We have discussed in the last paragraph water rates charged by the Government for irrigation from sources owned by them. This tended to restrict the discussion to sources other than those which are generally privately owned. There is, however, a cost of irrigation that has to be borne by the cultivator, no matter from what source he gets his water.

In the case of wells, there is the cost of occasional repairs and maintenance, as well as the cost of bullocks used for lifting water and of the wages of manpower needed for either looking after the bullocks or drawing the water. Similar is the position in respect of irrigation from privately owned tanks. The relative cost of irrigation from different sources is, therefore, a factor to reckon with. There are difficulties in the accounting of such costs, particularly in the evaluation of human and bullock labour supplied from the family. Generally speaking, Government canals provide the cheapest irrigation to the cultivator. Irrigation from State tube-wells is supposed to be more expensive; and the general belief is that well irrigation is most expensive. A detailed analysis of this problem was, however, beyond the scope of this study, though an attempt was made to obtain some data on the comparative cost of irrigation from wells, canals and State tube-wells. Costs have been calculated from the values of all inputs imputed at market rates. For relevance and meaningfulness in comparison such data should relate to the same part of a State. It was not possible for us to obtain all the relevant data in the course of the short period during which this enquiry had to be conducted. Limited data could, however, be obtained from the sample areas in Gujarat, Andhra and U.P. These show the comparative position in respect of cost of irrigation of the sources available in these areas.

TABLE 4.13  
*Comparison of Costs of Irrigation from Wells, State Tube-wells and Canals in Selected Areas*

State	Irrigation per acre of	Cost of irrigation (Rs.) from		
		Well	State tube-well	Govt. canal
(1)	(2)	(3)	(4)	(5)
Gujarat .. ..	Heavily irrigated crops ..	60—75	—	12—28
Andhra .. ..	Wet crops .. ..	300	—	50
	Lightly irrigated crops ..	60	—	15
U.P.	Paddy .. ..	—	25.0	4.4
	Sugarcane .. ..	—	37.5	26.0
	Wheat .. ..	—	13.5	9.9

4.30. In Table 4.13 the imputed cost of well irrigation has been compared with the water rates charged for canal irrigation for classes of crops in Gujarat and Andhra, while the cost of canal and of State tube-well irrigation in U.P. has been compared for three of the more important crops. The data tend to show that both in Gujarat and Andhra, canal irrigation is considerably cheaper than well irrigation not only for wet crops but also for lightly irrigated crops. The cost of well irrigation in these areas is between four and six times that of canal irrigation. In U.P., the cost of irrigation from State tube-wells is uniformly higher than that from canals for all the crops and is particularly so for paddy. Generalising from these three sets of figures, it can be said that well irrigation is more expensive than irrigation from the State tube-wells, which again costs more than irrigation from the Government canal. Fortunately for the cultivators, much of the cost of well irrigation is not in the nature of cash outlay; and its burden is not, therefore, felt directly. Besides, the utilization of the surplus capacity of bullocks and manpower is a factor which is not fully reflected in the

imputed cost. If these facts are taken into account, the differences in the costs will tend to narrow down.

#### NATURE AND PROBLEMS OF MINOR IRRIGATION IN AREAS SERVED BY MAJOR PROJECTS

4.31. The utilization of minor irrigation works in an area after the introduction of canals depends on many factors. The most important of these is whether the canal water is supplied in all the seasons, for all the crops and in adequate quantity. As long as a canal system cannot achieve this, there will remain a scope for the complementary functioning of minor irrigation works. We have tried to investigate the nature of this problem in the command area of nine major projects taken up for another study. Our general finding is that the minor irrigation works have gone out of use in parts of the command area of four of these projects. Thus in the area served by the Malampuzha (Kerala), Matatila (U.P.), Barwala canal of Bhakra Nangal (Punjab), a substantial number of instances have been reported of their going out of use. In the command area on the Mysore side of the Tungabhadra Project, very few minor works existed prior to the introduction of canal water. But on the Andhra side, wells have gone out of use, while tanks, which are of course fewer still supplement canal water for irrigation purposes.

4.32. In the command area of the other five major projects, minor works are being used to supplement canal water for irrigating vegetables and perennial crops like sugarcane, banana, etc., in seasons when canal water is not available or is not adequate. In the Kakrapar command in Gujarat, minor works are being used for irrigation in the hot months—March to June—when canal water from the project is not available. It is reported from Nasik (Maharashtra) that canal supplies from the Gangapur Project are not available on a permanent basis and on the desired rotation of five days for some crops. The ryots are, therefore, interested in making the maximum use of the existing wells to supplement canal irrigation. The complementary character of minor works in this area is indicated by the fact that though water rates are charged by the Government for new wells and tanks constructed within 200 yards of the Government water course, the cultivators are willing to pay these water rates and sink new wells. This is also the state of affairs in the Kakrapar project area in Gujarat. A large number of wells are being dug every year inspite of the water rate charged. The complementary role of minor works is also recognised by the Block authorities and financial assistance is provided by them in the Gujarat blocks to construct new wells and to maintain the old ones. In Maharashtra, the Revenue Department and Development Department are issuing taccavi loans for minor works.

4.33. The position regarding financial assistance in such areas is not the same in all the projects studied by us. In West Bengal, it has been reported to be the policy of the State Government not to undertake tank improvement work in the command areas of major projects like the D.V.C. and the Mayurakshi. Observations in the blocks in these areas reveal that a number of tanks have fallen into a state of disrepair and cannot be used even for supplementary irrigation. Similar is the position in a few other States. The cultivators in these areas, however, feel that concessional rates charged for water needed to fill up tanks so that these could be used for Rabi irrigation. In general, there is preference for minor sources of irrigation among the cultivators in these areas, particularly for Rabi crops.

4.34. In some States, the advent of canal irrigation has given a new lease of life to minor works in the command areas of the major project. In the command area of the Lower Bhawani Project, where seepage is reportedly a problem, wells and tanks have benefited. Cultivators utilize these minor works to store water and to irrigate crops when canal water is not available. Of course, they have to pay water rates. Wells located as far away as five miles have reportedly benefited. In order not to affect adversely the availability of water in the canals, the State Government have imposed a ban on digging new wells within two furlongs of the main canal and one furlong of the distributaries. But since there is no penal provision in the Act, cultivators continue to sink new wells in the command area in good numbers and are prepared to take the risk of penalty, if imposed.

4.35. The extent to which minor irrigation works are supplying irrigation benefits in the blocks selected for a study of 9 major irrigation projects in ten States can be seen from the figures given in Table 4.14. It will appear from this table that in 1959-60, the minor sources were providing a considerable extent of irrigation in the sample blocks in Gujarat, Kerala, Madras, Maharashtra, U.P. and even West Bengal. All this goes to show the complementary nature of minor works in the command areas of the major projects. The importance of minor works in these areas will not go down, at least, as long as the supply of irrigation water from canals is not adequate in quantity and perennial in nature.



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TABLE 4.14  
*Proportion of Net Area Irrigated and Cultivated Area Irrigated by Different Sources in the Sample Blocks in the Command Area of Nine Major Projects, 1959-60.*

Sample areas in States	Major irrigation source			Minor irrigation source						All sources		
	Wells		(3)	Tanks		Others		Total		(12)	(13)	
	(a)	(b)		(a)	(b)	(a)	(b)					
	(1)	(2)		(4)	(5)	(6)	(7)	(8)	(9)			(10)
Andhra Pradesh ..	36.6	5.3		data not available					63.4	9.2	100.0	14.5
Gujarat ..	58.0	22.2		48.2	7.0	15.2	2.2	—	42.0	16.0	100.0	38.2
Kerala ..	62.5	33.2		1.9	0.7	37.6	14.4	2.4	37.5	19.9	100.0	53.1
Madras ..	65.9	13.8		35.8	19.0	1.7	0.9	—	34.1	7.1	100.0	20.9
Maharashtra	99.7	N.A.		34.1	7.1	—	N.A.	—	0.3	N.A.	100.0	N.A.
Mysore ..	100.0	70.1		—	—	0.3	—	—	—	—	100.0	70.1
Orissa ..	94.4	26.4		—	—	—	—	—	5.6	1.6	100.0	28.0
Punjab ..	63.7	4.0		0.5	0.2	—	—	5.0	36.3	2.2	100.0	6.2
Uttar Pradesh	82.6	35.5		18.8	1.2	0.6	0.04	16.8	17.4	7.4	100.0	42.9
West Bengal				—	—	13.0	5.6	4.3	—	—	—	—

a = % net area irrigated.      b = % cultivated area irrigated.

a = % net area irrigated.

b = % cultivated area irrigated.

## CHAPTER V

### PROBLEMS OF CREATION OF NEW FACILITIES AND EXTENSION OF MINOR IRRIGATION

5.1. Large sums of money have been spent in the First and the Second Five Year Plans on the construction of new minor irrigation works and the extension of the minor irrigation facilities. Wells have been sunk in many areas, tanks excavated, tube-wells bored, other sources constructed and pump sets installed either on Government account or on private account through loans and subsidies. The funds for this purpose have been coming from the budgets of the Agriculture, the Irrigation and/or the Development Departments, and from the savings of individual owners. The Third Five Year Plan provides for an increase in the area irrigated from the minor sources from about 39 million to 47.5 million acres, which indicates the extent to which the development of minor irrigation has to take place during the next five years. In view of the need and the desirability of large-scale extension of minor irrigation, an attempt was made in the course of our survey to find out the physical and financial problems standing in the way of extension of minor irrigation facilities in the rural areas. On the one side, we have tried to assess the problems from the responses of the cultivators; and on the other, we have attempted to relate these to the costs and efficiency of the works constructed in the past. The data that could be collected are not adequate in all respects. But they give an idea of the problems likely to be faced in the future. We shall discuss the problems of creation of new works reported from the sample villages and then analyse the costs and efficiency of the existing works and against this background, assess farmers' plans for the extension of minor irrigation, their expectation of financial assistance, and related topics.

#### PROBLEMS OF EXTENSION OF MINOR IRRIGATION FACILITIES IN THE SAMPLE VILLAGES

5.2. Information was sought from the knowledgeable persons in the sample villages (126) on the major problems and difficulties that their villages had faced in the matter of extension of minor irrigation facilities through the creation of new works. As different sources of minor irrigation are not equally important in all areas, the sample villages have been classified on the basis of the predominant sources of irrigation in each area into four groups, (i) villages with tanks, (ii) villages with wells, (iii) villages with both tanks and wells, and (iv) villages with other works. The various problems reported from the villages have been classified by their nature. Some of the problems were of a physical nature like salinity of water, water-logging, lack of electricity connection etc., and some related to finance and other factors. Data, on these aspects could be collected only from 121 villages. It was reported from one of these villages in Kerala that irrigation was not required. In another 38 the scope for further extension of irrigation was reported to exist, but no problems were mentioned. In the remaining 82 villages, problems were indicated, sometimes more



than one in each. Table 5.1 gives their distribution by the type of problems :

**TABLE 5.1**  
*Percentage Distribution of Responses by the Nature of Problems in the Way of Creating New Irrigation Facilities*

Nature of problems	All villages	Villages with well	Villages with both tank and well	Villages with tank	Villages with works other than tank and well
(1)	(2)	(3)	(4)	(5)	(6)
<b>1. Physical Problems :</b>					
1.1 Lack of water .. ..	3.0	4.3	2.4	—	—
1.2 Sinking of wells costly due to low water table	15.8	23.4	12.2	—	—
1.3 Salinity of water .. ..	3.0	4.3	—	—	11.1
1.4 Lack of electricity or delay in electric connection	16.8	14.9	24.5	—	—
1.5 Works need to be fed by canal	5.9	4.3	2.4	50.0	11.1
1.6 Tanks not dependable ..	5.9	—	14.6	—	—
1.7 Water-logging .. ..	1.0	2.1	—	—	—
1.8 Change in river course ..	1.0	2.1	—	—	—
1.9 Small and fragmented holding	4.0	2.1	2.4	25.0	11.1
<b>TOTAL of (1)</b>	<b>56.4</b>	<b>57.5</b>	<b>58.5</b>	<b>75.0</b>	<b>33.3</b>
<b>2. Other Problems :</b>					
2.1 Lack of finance .. ..	34.7	34.0	39.1	25.0	22.3
2.2 Lack of initiative, cooperation among cultivators and lack of guidance and co-ordination	7.9	8.5	2.4	—	33.3
2.3 Ownership of land not settled	1.0	—	—	—	11.1
<b>TOTAL of (2)</b>	<b>43.6</b>	<b>42.5</b>	<b>41.5</b>	<b>25.0</b>	<b>66.7</b>
<b>TOTAL of (1) and (2)</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

5.3. About 56% of the entries in Table 5.1 suggest physical problems, the most important of which are lack of electricity and low water table. The former has been reported mostly from Andhra Pradesh and Punjab and the latter from Rajasthan, Mysore and Maharashtra. In these areas, sinking of wells is costly because of a low water table; and as a result of this the creation of new works is handicapped. Shortage or lack of electricity is generally felt by those desiring to install pump sets. Both these problems are faced in villages where well is an important source of irrigation, as in the Punjab, Bihar and U.P. Among other problems, lack of finance is the greatest hurdle. This again has been reported mostly from villages with wells, but does not seem to be confined to either the North or the South. Villages in Punjab and Maharashtra have reported financial difficulties, as also villages in Madhya Pradesh and Madras which are served both by tanks and wells. Four of the villages in the tank irrigation group reportedly faced one problem or the other. Of these, in two from Andhra, the problem was one of feeding the tanks from canals. Of the 41 villages where both tanks and wells are important sources of irrigation,

6 (15%) of which are from Andhra Pradesh reported that tanks were not a dependable source of irrigation.

5.4. The data in Table 5.1 are elaborated further in the Appendix Table C-22. It will appear from a perusal of this table that the scope for further extension of minor irrigation varies considerably among the States. The sample areas in Rajasthan, Gujarat, Maharashtra and some parts of U.P. and West Bengal face serious physical difficulties in the creation of new works. Either the water table is low which makes the cost of construction almost prohibitive and lifting of water difficult and costly, or the sub-soil water is saline. While financial aid may help in the creation of new works in many of the parts where well irrigation is feasible, the physical difficulties and limitations that many areas face in the extension of minor irrigation through the conventional works need to be given special attention.

#### COST OF CONSTRUCTION OF MINOR WORKS

5.5. *Cost of Construction.*—An attempt was made in this enquiry to collect data on the cost of the works constructed in the sample villages. Non-response was very heavy as can be seen from the figures in Table 5.2 below. In a few cases data were available for only one of the two items sought for, cost and area irrigable of the works.

TABLE 5.2\*  
*Cost of Construction and Irrigable Area per Work by Type of Minor Works*

Source of irrigation	Sample areas in States	RESPONDENTS				
		No. in sample blocks	No. reporting	Area irrigable by the sources reported (acres)	*Cost of construction per work (Rs.)	Cost of construction per acre of irrigable area (Rs.)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Tanks</i>	Kerala	19	10	11.38	420	370
	Madhya Pradesh	10	3	25.50	1,667	196
	TOTAL	29	13	36.88	708	250
<i>Pucca wells</i>	Andhra Pradesh	60	6	15.50	950	368
	Bihar	139	41	289.50	800	113
	Gujarat	104	26	135.50	2,923	561
	Madras	252	14	63.00	2,036	452
	Maharashtra	27	6	44.75	2,133	286
	Mysore	81	11	20.45	3,545	1,907
	Punjab	252	30	301.40	2,047	204
	Rajasthan	242	2	8.00	2,750	688
	Uttar Pradesh	127	6	36.00	1,450	242
	West Bengal	15	4	4.00	100	100
	TOTAL	1,299	146	918.10	1,855	295
<i>Kutcha wells</i>	Andhra Pradesh	910	12	25.45	546	257
	Gujarat	38	12	26.50	1,375	623
	Madhya Pradesh	163	2	1.78	750	843
	Mysore	109	7	7.00	1,343	1,343
	TOTAL	1,220	33	60.73	1,029	559

\*Calculation of cost and irrigable area per work based on those for which both the figures were available.

The inadequacy of data was largely explained by the fact that the works were old and accurate information on their costs were not available. Of the sample tanks, 96% were pre-1955-56. Besides non-availability of data, another factor to be reckoned with. Even the available cost figures did not seem to be equally dependable for tanks and for wells. The former seemed to be more on the low side, particularly in the case of old tanks for which the cost of improvement or restoration was reported as construction cost. The data in Table 5.2 have, therefore, to be read with these limitations in mind.

5.6. In spite of the limited utility of the data presented in Table 5.2, a few general inferences can be drawn from them. In the first place, the cost of construction is naturally higher for pucca wells than for kutchi wells, the figures for tanks not being very reliable for drawing any such comparison. But the cost of construction for both pucca and kutchi wells shows a wide variation among the States. The cost of a pucca well can vary from anywhere below Rs. 1,000 as in Andhra Pradesh, Bihar and West Bengal, to as high a figure as Rs. 3,600, as in Mysore. The cost of kutchi well varies similarly from about Rs. 550 (Andhra Pradesh) to about Rs. 1,375 (Gujarat). The cost of kutchi wells are much lower even in Bihar and U.P.; but these have not come in our sample. The cost of construction per acre of irrigable area shows wide fluctuations. In general, the data tend to show that kutchi wells are not really cheap when one assesses their cost in terms of units of irrigable acreage. Tanks and pucca wells appear to be the more economical sources.

#### ROLE OF FINANCIAL ASSISTANCE

5.7. Information was also collected about financial assistance given by the Government and institutional agencies for the construction of minor irrigation works. As regards tanks, data on their cost of construction could be obtained from only 3 out of the 42 sample blocks where only one tank had received any assistance for construction. Thus, for the purpose of the analysis, nothing can really be inferred about tanks. Our analysis of the role of financial assistance will therefore be confined only to wells.

5.8. In order to assess the impact of financial assistance, a comparison is attempted in Table 5.3 of the area irrigable per work (kutchi and pucca wells), and the cost of construction per acre of irrigable area of the works that had received financial assistance with those that had not. The comparison is made separately for pucca and kutchi wells.

TABLE 5.3  
*Cost and Efficiency of Wells Constructed With and Without  
Financial Assistance*

Type of work	Area irrigable per work (acres)		Cost of construction per acre irrigable (Rs.)	
	Those received financial assistance	Those not received financial assistance	Those received financial assistance	Those not received financial assistance
(1)	(2)	(3)	(4)	(5)
Pucca well .. .. .	6.14	6.55	297.2	464.8
Kutchi well .. .. .	1.84	1.29	550.6	110.2*

\*Relate to M.P. only. For others, cost data are not available.

While pucca wells that had received financial assistance for construction were on an average covering a slightly smaller acreage than those that had not, their cost per acre turned out to be considerably smaller. It may be said that pucca wells that had received aid proved more efficient. In the case of kutchha wells, the unaided ones covered less acreage; but in terms of cost per acre, they had turned out to be cheaper than the aided ones. While interpreting these figures, it needs to be borne in mind that the reported cost figures carry sometimes an element of inflation. This over-reporting is resorted to in order to get more financial aid. To the extent this is true, a comparison of the two categories of work on the basis of the data in Table 5.3 is distorted.

5.9. It may be worthwhile to attempt a State-wise comparison of the area irrigable per work for the aided and the unaided works. Table 5.4 gives relevant data separately for pucca wells and kutchha wells.

TABLE 5.4  
*Area Irrigable per Well Constructed With and Without Financial Aid, by State*

Sample areas in States	Area irrigable per well (acres)			
	Pucca wells		Kutchha wells	
	With aid	Without aid	With aid	Without aid
(1)	(2)	(3)	(4)	(5)
Andhra Pradesh .. .. .	2.58	1.70	2.12	1.21
Bihar .. .. .	6.90	4.53	0.00	1.00
Gujarat .. .. .	5.21	3.71	2.21	2.88
Kerala .. .. .	0.00	0.85	0.00	0.38
Madhya Pradesh .. .. .	0.00	5.08	1.26	2.95
Madras .. .. .	5.57	2.82	0.00	0.84
Maharashtra .. .. .	7.45	11.14	0.00	5.71
Mysore .. .. .	1.58	2.28	1.00	1.14
Orissa .. .. .	0.00	0.13	0.00	0.14
Punjab .. .. .	9.74	9.77	—	—
Rajasthan* .. .. .	4.66	11.98	0.00	2.00
Uttar Pradesh .. .. .	5.00	8.66	0.00	0.17
West Bengal .. .. .	1.00	1.54	0.00	0.71
All States sample .. .. .	6.14	6.55	1.84	1.29

\*The figure for aided wells relates to only two out of the total four blocks in the sample, while that for unaided relates to four. For the two blocks to which the figure of 4.66 relates, the corresponding figure for unaided wells is 5.61.

In all the States, the irrigable area per pucca well whether constructed with aid or not was larger than that for the corresponding category of kutchha wells. It is only in the States of Andhra, Bihar, Gujarat and Madras that wells that had received aid could irrigate on an average a larger area than those constructed without any aid. In the other States, the aided pucca wells had not proved better than the unaided ones in this respect. In Andhra, from which comes a very large percentage of the kutchha wells in the sample, the kutchha wells that had received financial assistance could irrigate, on an average, larger areas than those which had not received

financial assistance. In the other States, the position is just the reverse. Thus, the sample data do not suggest conclusively that wells constructed with financial aid have been significantly larger in size in terms of irrigable area. Whether it has been so because financial aid was not substantial or because the size of the work was determined by other considerations, cannot be conclusively analysed on the basis of the available data.

5.10. We have compared elsewhere the area irrigable per aided and unaided well—pucca and kutchra separately. It may be useful to examine in addition the percentage of wells that have received assistance, percentage of total area irrigated from them and the extent to which they provided irrigation in Rabi, 1959-60. Table 5.5 presents relevant data for the entire sample.

TABLE 5.5  
*Coverage of Wells in the Sample by Financial Assistance*

Type of well	Percentage of aided wells (in use) to total wells in use	Percentage of area irrigated from aided wells to total area irrigated (Kharif+Rabi) in 1959-60	Percentage of area irrigated in Rabi to total irrigated area	
			Aided	Unaided
(1)	(2)	(3)	(4)	(5)
Kutchra wells .. .. .	2.2	4.4	76.9	89.8
Pucca wells .. .. .	9.8	10.1	60.5	64.0

While aided kutchra wells formed about 2% of the total wells, the area irrigated by them constituted about 4% in 1959-60, which suggests that the area actually irrigated per work for the aided wells was probably larger than for the unaided wells. The position was not different in the case of pucca wells. In other words though the size of aided and unaided wells have not been different, the utilization has been generally higher from the aided ones. In Rabi, however, both the aided kutchra and the aided pucca wells irrigate less than the unaided ones. This was true particularly for Madhya Pradesh and Gujarat. On the other hand, in Mysore, they fared well as the unaided ones. In Andhra, the percentage of the area irrigated during Rabi season of 1959-60 was higher for the aided ones.

#### LIFE-TIME OF WORKS

5.11. Cost of a particular work should be examined not only in terms of the area it can irrigate but also in terms of its life-time. Efficiency of a particular work is also related to the time it is expected to serve. An attempt was accordingly made to obtain from the State Governments data on the normal life-time of different minor irrigation works existing in the States. There seems to be a fairly wide variation in the average life-time of a pucca well among the States. Table 5.6 gives summary details of the norms in respect of life-time etc., separately for each State.

TABLE 5.6  
Average Life-Time and Irrigable Area of Wells and Tanks in  
Different States

Sample areas in States	Average life-time (years)				Average area which can be irrigated (acres)		
	Pucca wells		Kutchha wells		Tanks	Pucca wells	Kutchha wells
	(1)	(2)	(3)	(4)			
Andhra	..	20	5	N.A.	3	2 to 3	N.A.
District Warangal	..	75-100	3	50 (minor)	1.5	0.5	100 (minor)
Andhra Pradesh	..	..	..	70 (minor)	..	..	400 (major)
Gujarat	..	20-25	N.A.	N.A.	6	N.A.	N.A.
Kerala	..	150	75-100	100-150	1 to 2	0.5 to 1	8-25
Madhya Pradesh	..	N.A.	N.A.	100	N.A.	N.A.	N.A.
Madras	..	20	20	N.A.	1 to 4	1 to 4	N.A.
Maharashtra	..	Permanent	N.A.	100*	6	3	1018*
Mysore	..	100	20	50 (a)	2 to 3	2 to 3	400†
	..	..	..	50 (b)	..	..	10
	..	..	..	75 (c)	..	..	30
	..	..	..	100 (d)	..	..	75
	..	..	..	100 (e)	..	..	300
Punjab	..	50	5-6@ (months)	N.A.	5 to 9	2 to 3	750
Rajasthan	..	20	5	—	5	5	N.A.
Uttar Pradesh	..	35-75	1-3	N.A.	5	5	N.A.
West Bengal	..	N.A.	N.A.	25	N.A.	N.A.	28 to 33

\*Under Irrigation and Power Department.

\*Under Revenue Department.

- (a) of less than 1 acre ayacut.  
 (b) of 10 acres and more but less than 50 acres ayacut.  
 (c) of 50 acres and more but less than 100 acres ayacut.  
 (d) of 100 acres and above but less than 500 acres ayacut.  
 (e) of 500 acres and above upto 1000 acres ayacut.  
 @ Generally in the 'Beet' area.

5.12. *Pucca Wells*.—It will appear from the data given in Table 5.6 that in Madras and Rajasthan, the average life-time of a pucca well is equated to 20 years, as compared to 150 years in Kerala. In Maharashtra it is expected to last for ever. The implication of a pucca well being reported as 'permanent' is not clear. The average area which can be irrigated by pucca wells, as can be seen from the figures in this table, ranges from 1.5 acres to 9 acres. In many cases, these figures showing the State norms compare well with the sample data. The figures received for States of Gujarat and Kerala are above the corresponding State average of the sample, while those of Punjab, Rajasthan and U.P. are below the sample average. The difference is particularly marked in the case of Maharashtra, Rajasthan and U.P. The sample average for Madras and Mysore falls within the ranges given by the respective State Governments.

5.13. *Kutch Wells*.—In the case of kutch wells, Kerala, Madras and Mysore report higher figures for the normal life-time. The Madras figure is equal to that for the life-time of a pucca well. The cost for both these types of wells are also the same, and to that extent, the distinction between pucca and kutch wells is blurred. By comparing the average area irrigated by a kutch well as revealed by the sample to that of the norms of State Governments, we find the norms higher in Kerala, Madras, Mysore, Rajasthan and U.P. but lower in Andhra and Maharashtra. We would like to make a comment here about the definition of kutch and pucca wells. Our observation in many areas tends to show that the distinction is not rigid. This point deserves some consideration by the State Governments.

#### FARMERS' PLANS FOR EXTENDING IRRIGATION

5.14. Information was also obtained from the sample respondents about their plans for extending irrigation. Out of 1,255 farmers in the random sample and 702 knowledgeable cultivators in the purposive sample, 19% from the first and 30% from the second category reported that they had some plan to extend their area under irrigation. Table 5.7 shows the distribution of respondents reporting plans for irrigation extension among villages grouped into categories according to the important source of irrigation.

TABLE 5.7

*Distribution of Respondents Reporting Plans for Irrigation Extension by the Category of Villages*

Category of Villages	Random			Knowledgeable		
	No. of respondents in the sample	No. of respondents reporting some plans	Percentage	No. of respondents in the sample	No. of respondents reporting some plans	Percentage
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Villages with tanks ..	90	1	1	54	3	6
Villages with wells ..	590	106	18	334	99	30
Villages with tanks and wells ..	437	107	25	250	97	39
Other villages ..	138	23	17	64	9	14
All villages ..	1,255	237	19	702	208	30

As is to be expected, very few respondents were planning to have irrigation works in the villages with tanks. On the other hand, in the villages where the predominant source is either well or both well and tank, the percentage of respondents reporting plans for works ranges between 18 to 25 in the random sample and between 30 to 39 in the knowledgeable group. The highest proportion is recorded in those villages that have tanks as well as wells as sources of irrigation. From this category of villages as well as from villages with wells, a very substantial number of the respondents wanted wells. In the random sample, a total of 178 respondents, 75% of those having plans, reported projects about wells. Eighty-six of them come from the tank-cum-well villages and 89 from the well villages. The distribution of respondents by the category of villages and the works planned is indicated in Table 5.8.

TABLE 5.8

*Distribution of Respondents by Category of Villages and Type of Works Planned*

Type of works planned		Category of villages					% to no. with plans
		With tanks	With wells	With tanks & wells	Others	Total	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Tank	Random	1	2	13	3	19	8
	Knowledgeable	2	5	23	1	31	15
Wells	Random	—	89	86	3	178	75
	Knowledgeable	—	70	57	4	131	64
Pump set	Random	—	9	16	14	39	16
	Knowledgeable	1	15	22	3	41	20
Tube-well	Random	—	5	—	3	8	3
	Knowledgeable	—	12	1	1	14	7
Others	Random	—	5	2	2	9	4
	Knowledgeable	—	4	6	1	11	5
TOTAL	Random	1	110	117	25	253	
	Knowledgeable	3	106	109	10	228	

5.15. What emerges from all these data is that construction of wells figures most importantly in the plans of the respondents for the creation of new works. The highest proportion of households (75% of the random sample and 64% of the knowledgeable) reporting work projects were planning to construct wells. About 16 to 20% of the respondents with plans were thinking to install pump sets. About one-half of them wanted these to be installed on wells. A few were also thinking of tube-wells.

5.16. The respondents who had in view the construction of minor works for irrigation extension were also asked about the type of works they had in mind, the anticipated cost of such works and the percentage assistance they desired from the Government. The data regarding wells are given separately for the random sample and the knowledgeable sample in Table 5.9.



TABLE 5.9

*Number of Respondents Planning to Extend Irrigation by Wells, Cost of Such Projects and the Assistance Expected*

Item	New construction		Deepening, boring, desilting, reconstruction, renovation and others		Total	
	Random	Knowledgeable	Random	Knowledgeable	Random	Knowledgeable
(1)	(2)	(3)	(4)	(5)	(6)	(7)
No. reporting .. .. .	111	81	59	48	170	129
Anticipated cost per work (Rs.)	2,198	2,795	1,000	1,361	1,813	2,313
No. of households requiring assistance	109	77	52	41	161	118
Expected assistance per, work (Rs.)	1,320	1,633	727	1,054	1,156	1,453
Percentage of assistance to cost*	59.3	62.6	66.1	69.5	60.3	64.0

\*Based on only the works for which both cost and assistance figures were given.

As between new construction and reconstruction-cum-renovation, a large number of respondents seem to have had plans for new construction. In the case of the random sample, the average anticipated cost per work comes to about Rs. 1,813, the cost per work for new construction amounting to Rs. 2,198, and that for renovation to about Rs. 1,000. Further, at the overall level, assistance was desired to the extent of about 60%. The percentage assistance desired was higher in the case of reconstruction and renovation operations (66%) like deepening, boring, desilting etc., than for new constructions (59%). This pattern is noticed among the respondents in both the knowledgeable and the random samples. For new constructions, the extent of assistance desired by the two groups of respondents amount to 59 and 63%, as compared to 66 and 70%, respectively for reconstruction.

5.17. Table 5.9 also shows that the assistance desired by the knowledgeable persons is generally higher in percentage terms than that mentioned by the respondents in the random sample. Considering that knowledgeable persons selected by us are generally the progressive and more well-to-do farmers, this tends to show that the attitude of depending on Government assistance is probably stronger among the better off sections of the cultivators. It should be added here that the financial assistance desired by the respondents was in the form of both loans and grants. We did not try to ascertain from them the extent of each for obvious reasons.

5.18. The data in Table 5.9 represent the average for the entire sample. In order to study regional variations, an attempt has been made in Table 5.10 to classify the area under study into four groups and present the data on the extent of assistance required for the wells, that the respondents had in view in each of these areas.

TABLE 5.10

*Number of Respondents Planning Irrigation Extension by Wells, Reported Cost of Works and Assistance Expected, by Regions*

Sample areas in States	Sample	No. re- porting	Antici- pated cost per work (Rs.)	No. of house- holds requi- ring assis- tance	Expec- ted assis- tance per work (Rs.)	Per- centage of as- sistance to cost*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Gujarat, Madhya Pradesh, Maharashtra and Rajasthan.	Random	91	1,458	83	831	52.6
	Knowledgeable	57	1,772	49	872	54.4
Bihar, Punjab and U.P.	Random	22	1,550	22	1,185	74.1
	Knowledgeable	25	1,956	25	1,377	70.4
Andhra Pradesh, Madras and Mysore.	Random	57	2,337	56	1,520	63.9
	Knowledgeable	46	3,148	43	2,028	65.8
West Bengal	Random	N.A.	N.A.	N.A.	N.A.	N.A.
	Knowledgeable	1	N.A.	1	N.A.	N.A.
All States sample	Random	170	1,813	161	1,156	60.3
	Knowledgeable	129	2,313	118	1,453	64.0

\*Based on only the works for which both cost and assistance figures were given.  
N.A. = Not available.

5.19. The proportion of costs needed as assistance from the Government seems to be highest (70-74%) in the sample region represented by Bihar, Punjab and U.P., though the anticipated cost per well (Rs. 1,550-Rs. 1,956) is not the highest in this region. On the other hand, in the Gujarat, Maharashtra, Madhya Pradesh and Rajasthan region, the assistance required stands lowest (53-54%), though the reported cost is also slightly lower (Rs. 1,458-Rs. 1,772). In Maharashtra, however, the respondents desired 67% of the cost to be met by financial aid in the case of construction of new wells. On the basis of the sample data, the average anticipated cost of construction of a new well in Maharashtra comes to Rs. 2,000. This implies that a cultivator with plans for the extension of well irrigation needs assistance to the extent of Rs. 1,320 for constructing a new well. It may be noted here that under the 'Integrated Wells Scheme', loans were given in Maharashtra upto a maximum of Rs. 2,500 for constructing a new well and Rs. 1,000 for repairing an old well.

5.20. So far we have discussed the cost per work as anticipated by the respondents and the percentage assistance desired by them for creating new wells or for the renovation of the existing ones. It will be useful now to compare these with the actual cost per work and the percentage financial assistance actually given in the field. Table 5.11 attempts to put together the relevant figures.

TABLE 5.11

*Cost and Financial Assistance Expected (Based on Random Sample) and Received for Construction of Wells*

Item	Actual in the past (Rs.)	Expected (Rs.)	Col. 3 Col. 2 x 100
(1)	(2)	(3)	(4)
Cost of construction per work .. ..	1,680	2,242	133
Assistance per work .. ..	939	1,328	142
Percentage of assistance to cost .. ..	55.9	59.3	106

The actual cost of construction based on the data for the last 5 years turns out to be 33% less than the cost anticipated by the respondents for the wells planned. On the other hand, the assistance expected is higher by 42%, and the percentage of cost desired as assistance is higher by 6. While the actual costs have gone up in the meantime, it is not possible for us to say whether the order of rise has been in reality as high as 33%. What is more important is that the proportion of the cost expected as assistance shows a rise, thus indicating the direction of dependence on Government aid.

### TANKS

5.21. As indicated earlier, 237 households out of the random sample of 1,255 had some projects in view for extending areas under irrigation. About 8% of them had plans for tanks. The corresponding figure for respondents in the knowledgeable group was 15%. On the whole, a very small proportion of respondents reported plans for the extension of irrigation by tanks; and those who favoured tanks were from the comparatively more progressive and well-to-do classes. The higher figure for the knowledgeable persons is a pointer in that direction. Table 5.12 gives data on the costs of such projects and the assistance desired by the respondents.

TABLE 5.12

*No. of Respondents Planning to Extend Irrigation by Tank Projects, the Cost of Projects and Assistance Expected for the Projects*

Item	Construction of tank and construction and raising of tank bunds		Others		Total	
	Random	Knowledgeable	Random	Knowledgeable	Random	Knowledgeable
(1)	(2)	(3)	(4)	(5)	(6)	(7)
No. reporting ..	13	20	6	13	19	33
Anticipated cost per work (Rs.) ..	4,125	2,933	20,260	1,372	10,331	2,436
No. of households requiring assistance ..	13	13	6	13	19	26
Assistance per work (Rs.) ..	3,975	2,594	20,201	1,153	10,216	1,921
Percentage of assistance to cost* ..	96.4	79.8	99.7	84.1	98.9	81.0

Based on only the works for which both cost and assistance figures are available.

It appears from the data in Table 5.12 that assistance required was 99% of the cost of the tanks projects in the case of random sample. The figure reported by knowledgeable persons was lower—81%. The percentage assistance varies only slightly between works of construction including raising of tank bunds and works of other types.

5.22. Table 5.13 attempts to bring out the regional variation in the percentage assistance required for the tank projects reported by the respondents.

TABLE 5.13

*Number of Respondents Planning to Extend Irrigation by Tank Projects, the Cost of Projects and Assistance Expected for the Projects by State*

Sample areas in States	Sample	No. reporting	Anticipated cost per work (Rs.)	No. of households requiring assistance	Expected assistance per work (Rs.)	% assistance to cost*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Andhra Pradesh	Random	11	16,471	11	16,287	98.9
	Knowledgeable	18	2,460	17	2,307	93.8
Assam	Random	3	1,000	3	800	80.0
	Knowledgeable	1	N.A.	1	N.A.	N.A.
Gujarat	Random	—	—	—	—	—
	Knowledgeable	2	N.A.	2	N.A.	N.A.
Madhya Pradesh	Random	4	2,500	4	2,500	100.0
	Knowledgeable	9	2,611	4	1,322	50.0
Orissa	Random	—	—	—	—	—
	Knowledgeable	2	1,500	2	500	100.0
West Bengal	Random	1	8,000	1	8,000	100.0
	Knowledgeable	1	2,500	—	—	—
All States	Random	19	10,331	19	10,216	98.9
sample	Knowledgeable	33	2,436	26	1,921	81.0

\*Based on only the works for which both cost and assistance figures were given.

The assistance required as a percentage of the anticipated cost of the works does not show any large variation among the States, except for Madhya Pradesh where it comes down to 50% in the case of knowledgeable respondents and for Assam where it comes to 80% for the random sample group.

#### DIFFICULTIES IN EXECUTION OF THE PLANS

5.23. The respondents were also asked about the difficulties they envisaged in executing their plans for irrigation extension. The responses obtained are given in Table 5.14 for the different types of works.

**TABLE 5.14**  
**Distribution of Respondents With Plans for Irrigation Extension by the Nature of Difficulty Envisaged**

Nature of difficulty	Random Knowledgeable	
	No.	No.
(1)	(2)	(3)
<i>Tanks</i>		
1. Financial .. .. .	10	23
2. Others .. .. .	2	3
3. No difficulty .. .. .	5	2
4. Not stated .. .. .	2	3
TOTAL .. .. .	19	31
<i>Wells</i>		
1. Financial .. .. .	148	102
2. Difficulty of getting loans .. .. .	4	4
3. Other difficulties .. .. .	10	8
4. No difficulty .. .. .	15	15
5. Not stated .. .. .	1	2
TOTAL .. .. .	178	131
<i>Pump Sets</i>		
1. Financial .. .. .	19	12
2. Difficulty of getting loans .. .. .	6	2
3. Lack or shortage of electricity .. .. .	1	3
4. Other difficulties .. .. .	6	5
5. No difficulty .. .. .	6	14
6. Not stated .. .. .	1	5
TOTAL .. .. .	39	41
<i>Tube-wells</i>		
1. Financial difficulty .. .. .	4	3
2. Difficulty of getting loans .. .. .	1	5
3. Lack or shortage of electricity .. .. .	3	5
4. Not stated .. .. .	—	1
TOTAL .. .. .	8	14

The most common of the difficulties reported is finance. This is, indeed, the most important problem reported by the respondents whether they were planning to construct tanks or wells or tube-wells or install pump sets. Among the other difficulties, lack of cooperation from the fellow cultivators is an important difficulty reported in respect of wells. Non-availability of materials for renovation of wells and shortage of labour figure in some instances in the case of wells. In the case of pump sets, the difficulty in getting electricity is reported from Punjab, Andhra Pradesh and Madras. Shortage of electricity is also reported for tube-wells.

5.24. In some parts of the Deccan, the wells derive their supply of water from sub-soil water seams, the exact location of which cannot be easily predicted. As wells have to be excavated here in rocky terrain, they entail a fairly heavy expenditure and investment which goes to waste if the water seam is not struck. The ordinary cultivators with their lean financial resources hesitate to take such risks. A similar problem is also reported from Rajasthan where the water, if at all struck, is available at great depth;

and the cost of construction is pretty high because of the rocky strata. Sometimes the quantity of water struck is very small; and even the water struck may be saline. These factors dissuade cultivators from embarking on projects for the construction of new wells. They prefer to deepen the existing wells either by blasting the rocks at the bottom or through deeper boring. In these areas, the real problem is that the indigenous methods of blasting as well as boring are not very effective. Air compressors are more effective, convenient as well as economical. But the bottleneck is that the servicing of the blasting and the boring machines is neither adequate nor available at the right time. Sometimes, the cultivator is handicapped by his limited financial resources and has to forego their use on that account. The problem is thus two-fold—shortage of these machines and equipment and non-availability of these and their servicing facilities within easy physical and financial reach of the cultivators.

5.25. Similar problems have been reported in respect of pump sets. In Bihar, the cultivators wanted power pumps of 1.5 to 2.0 horse power for their wells. But the Block authorities there generally sanction pumps of 5.0 B.H.P. which are too big to suit the size of holding and purse of the ordinary cultivators. The shortage of pumps was also acutely felt by the cultivators. In Orissa, the Government provides oil engines on hire for lift irrigation; but cultivators do not generally go for these. The oil engines are too heavy to allow easy transportation to interior fields. A whole-time operator is not provided and the sets are worked by inexperienced hands, resulting in frequent breakdown. Repair becomes costly and the servicing facility is not easily available. The problem of servicing is again important in Assam for pump sets. Their maintenance poses a serious problem as they are scattered in interior areas. The income from each set has been reported to be about Rs. 450 annually, whereas the recurring cost has been given to us at as high a figure as Rs. 2,000.

#### STANDARD OF COSTS AND REFUNDS FROM MINOR WORKS

5.26. An attempt was made to collect data from the States on the standards they prescribed for adequate returns from different types of minor works. From the replies received up to the time of reporting, it appears that in almost all cases, the consideration that seems to have weighed heavily with the State Governments on the question of return was the ability of the works to irrigate food crops. Table 5.15 summarizes the position at a glance for the States from which information has so far been received

TABLE 5.15  
*Norms of Adequate Return from Minor Works*

Government of State	Standard of adequate return prescribed	
	Pucca wells	Kutchra wells
Gujarat .. ..	60% area under food crops.	Not given.
Madras .. ..	2 tons per acre for two crops.	2 tons per acre for two crops.
Maharashtra .. ..	2/3rd area should be under food crops, banana and coconuts.	2/3rd area should be under food crops, banana and coconuts.
Mysore .. ..	(No standard prescribed).	
Punjab .. ..	Addl. production 7 mds. or 1/4th ton per acre to give a net return of Rs. 1,000—Rs. 2,000 in 4 yrs.	Not prescribed. No loans given.
Rajasthan .. ..	The funds are given as loan.	Not given.
U.P. .. ..	(No standard prescribed).	

In Gujarat and Maharashtra the norm lays down that about 60% of the area should be under food crops. Punjab and Madras lay down standards in terms of yield; the former in terms of additional yield of 7 mds. or  $\frac{1}{4}$ th ton per acre or a net return of Rs. 1,000 to Rs. 2,000 in four years and the latter at 2 tons per acre for two crops. In Madras and Maharashtra, the standards prescribed for pucca and kutchha wells are the same.

5.27. In some States, the norms are laid down in terms of financial outlay per acre of the irrigation potential created. For illustration, in Maharashtra and Gujarat, the norms are prescribed as below :

Tanks		Bandharas	
(i) New works	Rs. 600 per acre	(i) New works	Rs. 300 per acre
(ii) Complete renovation	Rs. 600 per acre	(ii) Improvement	Rs. 150 per acre
(iii) Partial renovation	Rs. 300 per acre		

For works under the Cooperative Lift Irrigation scheme in Maharashtra, the norms are Rs. 300 per acre for works with a command area not exceeding 500 acres and Rs. 250 per acre for those above 500 acres. In view of the rising costs, there is a proposal to raise the norms to Rs. 350 and Rs. 300 per acre. In Andhra Pradesh, the yard-stick followed for the restoration of breached and abandoned tanks is Rs. 250 per acre of the ayacut to be developed under each tank. The maximum limit in terms of outlay for construction of minor irrigation projects by the Irrigation Department and the Revenue Department in Orissa are Rs. 250 and Rs. 150 per acre respectively. The rates are now proposed to be raised to Rs. 400 per acre for reservoirs and Rs. 250 per acre for diversion weirs in the Third Plan. For tanks undertaken for restoration by the Tank Improvement Department of West Bengal Government, the cost of a project was previously fixed at Rs. 100 per acre and no work exceeding this rate could be taken up. Since the limit was found too low and many works could not be taken up at all, the condition was waived later. In Kerala, the expenditure on minor works is reportedly limited to the maximum of Rs. 400 and Rs. 250 per acre of area benefited for tanks and wells respectively.

5.28. In some States the standard for returns are thought of in terms of a minimum percentage return on the capital outlay. For example, in Mysore, in general, a 2% return is insisted upon in the case of works costing Rs. 50,000 or less and 3% in the case of works costing more. The restriction of 2% is, however, relaxed in the case of the restoration of minor works. In Rajasthan, the Jawai Tank—a medium project—does not seem to fetch sufficient financial return; and the State Government feels that a return of 4½% on the loans advanced should not be insisted upon.

#### CAPACITY TO IRRIGATE IN RABI

5.29. The efficiency of a particular type of minor irrigation work is judged not only by its cost per acre of the area which it can irrigate and the duration (life-time of work) for which it can irrigate, but also by its capacity to supply water when it is needed most by the cultivator. Pucca wells can be depended upon mostly for the entire agricultural year (Kharif as well as Rabi). On the other hand, tanks can serve a comparatively larger area in the season of rainfall than in other seasons. In the later, there is a good shrinkage in the area served by them. Tanks are generally fed by rain water in their catchment area and rains in India are mostly from the

monsoons in summer—mid June to September. Winter rains occur in a few areas only like Madras and parts of Kerala. And, there, the tanks offer maximum irrigation in the Rabi season. Otherwise, the irrigation from tanks is maximum generally from the middle or early part of the Kharif, to the early Rabi; and the area served by them shrinks in late Rabi. Since the need of irrigation water is generally more acute in the Rabi season, the efficiency of a particular work may be examined also from the angle of its capacity to irrigate in this lean season.

5.30. Table 5.16 gives data on the percentage of area irrigated by different sources during the Rabi season to the total area irrigated in Rabi for 1959-60.

TABLE 5.16  
*Proportion of Rabi Acreage Irrigated by Different Sources*

Sample areas in States	Percentage of area irrigated in Rabi by different sources to total irrigated area in Rabi in 1959-60		
	Tank	Pucca well	Kutch well
(1)	(2)	(3)	(4)
Andhra Pradesh .. .. .	40.7	4.7	51.1
Assam .. .. .	—	—	—
Bihar .. .. .	9.7	46.5	—
Gujarat .. .. .	12.9	65.5	21.4
Kerala .. .. .	65.6	12.6	2.4
Madhya Pradesh .. .. .	4.3	65.2	29.6
Madras .. .. .	88.2	7.8	3.9
Maharashtra .. .. .	—	1.6	1.0
Mysore .. .. .	26.8	42.9	30.2
Orissa .. .. .	—	3.0	79.8
Punjab .. .. .	—	56.3	—
Rajasthan .. .. .	1.5	68.1	1.1
U.P. .. .. .	8.3	44.9	Negligible
West Bengal .. .. .	5.5	1.5	1.7
All states sample .. .. .	17.4	35.5	2.8

Of the total area irrigated in Rabi, about 36% got irrigation benefit from pucca wells, 17% from tanks and 3% from kutch wells. In eight of the States, pucca well remains the most important of the three sources.

#### PEOPLE'S CONTRIBUTION

5.31. In some cases, it has been reported that the practice of insisting on a certain percentage of costs of works benefiting a group or a community as people's contribution is holding up progress in the creation of new minor works. In Orissa, during the First Plan, people's contribution at the rate of  $\frac{1}{3}$ rd of the total cost either in cash or in kind was made a pre-requisite for any minor irrigation work. The cooperation of the people, however, was not encouraging and, as a result, progress in this field met with a set-back. The policy has since been revised. The State bears the entire cost of the projects in the block as well as the non-block areas. In the selected blocks of Kerala it is reported that when minor irrigation works are given to local bodies like panchayats and *ad hoc* committees, 'shramdan' is compulsory. Generally 'shramdan' is required to the extent of 25% for



earth work and 5% for masonry work. In practice, however, 'shramdan' is not readily forthcoming with the result that the panchayats and local bodies have lost heavily. In the selected blocks of Rajasthan, works like repair and construction of tanks and wells are carried out by the Vikas Samiti with the help of people's contribution, which is 50% of the total cost for items requiring earth work and 25% for items of masonry work. Only the balance is met by the Irrigation Department. But in one of the sample blocks, the panchayats could not undertake four schemes as the people did not come forward for 'shramdan'. Similarly, in another block people's contribution was insufficient and not even a single tank could be constructed.

5.32. In West Bengal, for "small irrigation" works like the construction of bunds, diversion weirs etc. executed by the Agricultural Department with the assistance of *ad hoc* beneficiaries committees, beneficiaries are required to undertake to contribute 55% of the total cost in labour or cash. In the case of projects under the Tribal Welfare scheme, the contribution is lowered to 32.5%. Beneficiaries usually contribute their part in form of labour. The irrigation projects undertaken by the Agricultural Department of Assam—mainly bunds, irrigation channels, etc.—are executed with people's contribution amounting to 50% of the total estimated cost for new works and to 60% for protection and remodelling of old works. In Maharashtra also, the Agricultural Department is stated to have secured farmers' participation in its works like bunding, sinking of wells etc. through Farmers' Unions where they exist. No special problem in securing people's participation has been reported from the sample blocks in these States.

5.33. It appears from our field study that the practice regarding seeking people's contribution for minor works benefiting a community or a group of people lacks a uniform basis. There is generally no proportion of cost, fixed rigidly for such contribution in any State, except probably for the 'small irrigation' works in one or two of the eastern States, notably West Bengal. But this flexibility is interpreted differently by the Agriculture and the Development Departments. As far as community works executed with Community Development funds are concerned, there is, in most States, an insistence on some amount (whatever the proportion) of such contribution. Such insistence does not seem to be there for comparable works executed from the GMF or Agricultural Department funds. Efforts to secure genuine people's contribution seem to have been successful generally in cases where people have been involved in the planning of the works through their own organisations like beneficiary committees, Farmers' Unions or Vikas Samitis and panchayats. The panchayats, being general-purpose statutory bodies, seem to have been less effective in eliciting people's contribution for minor works than *ad hoc* bodies set up solely for the purpose of irrigation.

5.34. There is another way in which the lack or shortage of people's cooperation acts as a check in the creation of new minor works. In Mysore, under the present rules, the State Electricity Board instal electric pump sets for irrigation on behalf of the farmers. But at least 75% of the applicants must be ready with their pump sets before the Board could take up its portion of the work. The experience so far indicates that such a high percentage of the people are not ready at a time and the work suffers.

It has been decided lately to reduce the figure to 50% for one year, in the first instance, to accelerate the tempo of lift irrigation. Another illustration is provided by the difficulties met by the Tank Improvement Department of West Bengal in taking up some schemes of reconstruction of tanks. Even for almost completely silted up tanks, there are some cultivators who take advantage of the little water still left in these. These beneficiaries object to the renovation of such tanks. Besides, they do not want to be charged water rates after the tank is renovated. They do not place themselves in the same category as those who are likely to receive irrigation benefit for the first time.

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## CHAPTER VI

### PROBLEMS OF MAINTENANCE OF MINOR IRRIGATION WORKS

6.1. The analysis of the growth of minor irrigation works and their impact on irrigable area, cropping intensity and pattern, etc. has thrown into focus, among other things, the difficulties caused by the inadequacy and even absence of irrigation water in a large number of minor irrigation works. The basic problem in most of these cases is efficiency of management and proper maintenance of these works. In the case of major irrigation projects almost the entire burden of administration and management—from the planning and execution of the project to the continuous administration including the conveyance and distribution of water to the beneficiaries through suitable outlets—is borne by the State. The management of the minor irrigation works, however, follows diverse patterns. Ownership vests in different people and institutions, and differs in type; various agencies are associated with the projects at various stages. Effective control and maintenance of innumerable and widely scattered small works present difficulties of administration and co-ordination. In short, there are problems connected with the physical side of maintenance, and the execution and management of the maintenance operations. These are mixed up with the problems of administration and organisation. It is the first group of problems that will be taken up in this chapter, with particular reference to tanks and wells.

6.2. The data collected in the course of the field investigation threw light on the existing condition of these works, some of the problems involved in their management, the agencies responsible for their maintenance, and the part played by them in the promotion of these facilities. Data have been obtained at the village level about different works and their state of maintenance. These give us some broad indications about the directions in which the problems need to be looked into and tackled.

### PROBLEMS OF MAINTENANCE OF TANKS

6.3. Of the 257 tanks in the sample, about 5% were found to be not in use. These tanks are mostly in Andhra in Sangam block (Warangal district) where as many as 8 tanks out of 10 (80%) were not found to be in use. The field reports on the maintenance of tanks that are in use are not very encouraging either. Only 9% are said to be in good condition, as compared to 43% reported to be poorly maintained. The condition of the remaining 48% can be described only as tolerable. Though generalisation on the basis of this limited sample cannot be very firm, the available information for tanks in other areas suggests that tanks receiving financial assistance are not maintained better. The main problems in the maintenance of tanks are prevention of tank-bed cultivation, and of encroachment on the foreshore, deweeding, desilting of the channels and (earthwork) repair of the embankment. The latter group of works are to be carried out periodically every few years. Besides, waste weir and sluices (masonry work), desilting and restoration of tanks become necessary after the lapse of some time. These require larger investment and bigger works, and are to be done in longer cycles.

6.4. *Cultivation of the Foreshore and Bed of Tanks.*—Cultivation of the foreshore of tanks is a common practice in many areas in Andhra, Madras and Mysore. Cultivation of the foreshore areas accelerates the erosion of soil in the catchment area of the tank and adds to the silting process. Prevention of such cultivation is, therefore, considered a necessary aspect of tank maintenance. The foreshore usually includes the land above the water-spread area of the tank; such area may be defined in terms of storage or of impounding during a period. Technically speaking, it is not necessary that the foreshore would include areas only above the full immersion level of the tank; it may include any area which is above a certain defined level of storage. In the case of 'series' tanks the foreshore of one tank is in the form of a continuation of the ayacut area of the tank above it and is better in respect of moisture availability than dry land. That is why there has always been a tendency for cultivators to encroach on such lands. The foreshore of tanks is in some cases Government land, and in others private or zamindari land. In the case of private or zamindari foreshore land, the encroachment has in many cases been legalised through the issue of pattas and other settlement records. The main problem in the prevention of foreshore cultivation is one of eviction of the encroachers. Unless this is done, the tanks cannot be saved from excessive silting. This is a problem which is rather difficult to solve because of the pressure on land and the difficulty in the way of eviction of persons already cultivating it. The State Governments seem, however, to be fully aware of this problem, the complexity of which has, however, been baffling them.

6.5. Cultivation of tank-bed is in reality a further extension of foreshore cultivation into areas which are technically characterised as part of the bed of tanks. Because of the relatively high fertility of such land, there is always a marked preference among farmers in these areas for encroachment on such land so much so that there is often a competition among them. This has been reported from our sample areas both in Madras and in Andhra. In the Ramanathapuram district (Madras) where failure of the north-east monsoon is not uncommon, this practice has continued on such a large scale that it has been reportedly recognized. Titles of ownership (pattas) had to be conferred for cultivation of the tank-beds during the zamindari period. If this practice continues, it becomes difficult to do any desilting work in the tanks or to undertake any improvement work that will result in the submersion of the areas already encroached upon. In Andhra, there is a provision for the imposition on cultivators encroaching on tank-beds of a penalty tax equal in amount to about five times the usual rate of revenue in the area. But even such a high penalty tax does not seem to have acted as an effective disincentive. It is reported that the P.W.D. feels helpless in the matter as the Revenue Department seems to allow such cultivation after imposing the penalty tax. One way of stopping this practice seems to be to raise the penalty tax to a much higher level.

#### SILTING AND RATE OF DECREASE IN AYACUT

6.6. How far silting and poor maintenance of tanks have affected their capacity to irrigate cannot be estimated with precision on the basis of the data available at present. In almost all the sample blocks where tank irrigation is prevalent, silting has been reported as a common complaint. It results partly from natural causes, partly from encroachment into the tank-bed and unauthorised cultivation of their foreshore, and partly from

denudation of the catchment area of vegetation, and the resulting increase in soil erosion. An attempt is made below to give an idea of the extent of loss in the irrigable area as a result of the silting of tanks.

6.7. In Andhra Pradesh, the tanks that existed in 1955-56 had an *ayacut* of approximately 30 lakh acres. The area that was actually irrigated in 1955-56 was not less than the *ayacut* in seven districts,\* while in the remaining districts the gap was 6.8\* lakh acres. Considering the *ayacut* of tanks in the latter districts the gap amounts to 30% while if we take the total area irrigated and total *ayacut* for all the districts the gap is only 12%. As the gap is due to neglect in maintenance and repairs, it could be attributed to silting. The Irrigation Department of the Madras Government made a study of 122 tanks in the State and found them distributed as follows by the extent of reduction in capacity :

Extent of reduction in tank capacity							Tanks	
							No.	%
More than 50%	..	..	..	..	..	..	13	11
25 to 50%	..	..	..	..	..	..	51	41
10 to 25%	..	..	..	..	..	..	50	41
Less than 10%	..	..	..	..	..	..	8	7
TOTAL	..	..	..	..	..	..	122	100

On an average, silting was found to have reduced the capacity of these tanks to the extent of 25%. Data provided by the Desilting-cum-Reclamation Division of the Madras Government on the 34 tanks on which desilting-cum-reclamation operations were done, show that silting had reduced their capacity by 15%. Before desilting, only 85% of the registered *ayacut* was under irrigation. After desilting-cum-reclamation, 94% of the originally designed storage capacity could be restored.

6.8. According to the information obtained by us from discussion with State Government officials, the capacity of tanks in Mysore had generally been reduced to 30—50% in the course of 50 years which is taken as the average life of a tank. In Kerala, the Minor Irrigation Committee (1960) gave in their report a list of irrigation tanks alongwith their condition. In Trivandrum district alone, out of the 1,003 irrigation tanks shown in the records as many as 44% are partly silted up; and another 398 tanks on record with a registered *ayacut* of 4,500 acres are completely silted up. Sites of 10 tanks which had an aggregate *ayacut* of 166 acres now have trees planted there. The estimated reduction in the total *ayacut* due to silting in this district is about 47%. In one of the blocks, Badnawar of Dhar district in Madhya Pradesh, 8 tanks irrigated 203 acres before 1955-56 but only 134 acres in 1959-60, thereby showing a decrease in irrigated area by about 34% in about five years. The majority of the tanks in Chattarpur district (Madhya Pradesh) are reported to have silted up, while embankments of some have given way in places. Weeds have grown in the tank-bed, and waternut culture has worsened the condition further. As the waternut plants are not removed, they settle down year after year adding speed to the silting process.

\*Based on data printed in the COPP report on Minor Irrigation Works (Andhra Pradesh) Pages 37-39.

6.9. While additional capacity to irrigate land is created by new tanks or the restoration of old ones, that of the other tanks goes on decreasing by the silting process. For obtaining an estimate of the net addition to the irrigation potential, the decrease in capacity that goes on from year to year should be deducted from the capacity of the new additions. It should be noted that the physical area which can be irrigated from a tank may not necessarily decrease because of silting. What may very often happen is that the ayacut remains unchanged; but the supply of water per acre of ayacut decreases with the reduction in capacity. What is important is that the available volume of water progressively decreases with the result that only the areas in the lower slopes of the command get an adequate supply from the tank. The State Governments do not seem to be following the practice of estimating the net annual position regarding the irrigable capacity of the tanks. In fact, it is doubtful if all the States collect enough data for this netting process.

6.10. For calculating the net increase in the irrigation potential for tanks, the practice in Madras seems to be to work out the decrease in ayacut of the tanks for a particular year, at the rate of 1% of the ayacut as of that year. In Srikakulam district, Andhra, the corresponding rate is reported to be roughly 1.3% for major tanks (with an ayacut of more than 200 acres) and 2% for minor tanks (with an ayacut of less than 200 acres). In Kerala, the rate is still higher, about 3%, perhaps on account of the frequency of breaches caused by heavy rainfall. In Mysore, the rate of decrease in the ayacut because of silting is assumed to vary from 0.2% in tanks of the smallest size to between 0.5 and 1% in the large sized ones, as can be seen from the figures given below :—

Size of tank by ayacut area	Rate of decrease per year due to silting
Less than 1 acre	0.2%
10 acres and above but less than 50 acres	0.3%
50 acres and above but less than 100 acres	0.4%
100 acres and above but less than 500 acres	0.5%
500 acres and above upto 1000 acres	0.5 to 1.0%

In contrast to Srikakulam district, Andhra, the percentage allowance here seems to rise with increase in the size of the tanks. Perhaps the argument here is that with larger catchment area, the rate of silting goes up in areas of heavy rainfall. In Rajasthan, the decrease is estimated to be 0.3 to 0.4% of the ayacut per year. The dead storage capacity in this State is assumed to form 10% of the total storage capacity, and is assumed to be silted up within a period of 20 to 40 years, after which the bunds will have to be raised to create new dead storage. Information obtained by us, thus, shows the following rates of reduction in capacity due to silting, as per data obtained from the State Governments :

State	Rate of reduction per year (% of aya cut)
Andhra	1.3 to 2.0
Kerala	3.0
Madras	1.0
Mysore	0.2 to 1.0
Rajasthan	0.3 to 0.4

It was not possible for us to check or verify the accuracy of these figures.

6.11. *Technical Standards and Mechanical Equipment.*—In the selected blocks in Trivandrum district of Kerala, many of the irrigation tanks have

reportedly no proper shutters; and even for those that have been provided with shutters, there is no one to operate them. In either case, water flows out from the tanks involving much wastage. In Warangal district of Andhra, the bunds, the sluices, and the weirs of many tanks are reported to be in a deplorable state. In a sample block in this district of Andhra, about 30 tanks were breached during the last year's cyclone. But practically nothing has been done to repair them properly; the cultivators, however, did some ring bunding in a crude way in some cases. In the same block a large number of tanks which are in series have precarious bunds which may be washed away under pressure, thereby endangering the safety of the whole series of tanks.

6.12. The process of silting cannot be completely stopped; it can only be reduced through suitable maintenance measures. After a number of years of silting, depending on the nature of maintenance, a tank needs restoration or improvement. Restoration may be effected through raising and strengthening the embankment and ancillary measure or through desilting or both. This restoration is also a periodic process of a longer cycle. Unless it is attended to in time, the tank may have to be abandoned.

#### RESTORATION OF TANKS

6.13. The restoration and improvement operations seem to have been neglected in many areas over a considerable period. As a result, restoration of tanks, both ex-zamindari and others, is posing a serious problem on account of the heavy capital cost involved. A rough idea of the magnitude of the problem may be obtained from the fact that according to the Master Plan for the restoration of tanks in Andhra Pradesh, the total cost of restoring 42,552 tanks to the P.W.D. standards (estimated at the rate of Rs. 50 per acre) has been found to be of the order of Rs. 5.70 crores and another Rs. 10 crores (at the rate of Rs. 160 per acre) for bridging the gap in irrigation between the settled ayacut and the area under actual irrigation. Table 6.1 gives data on the expenditure on and the area benefited from the restoration of tanks effected in the recent period in a few States :

TABLE 6.1  
*Progress of Restoration of Tanks in Selected States*

State	Period	No. restored	Average expenditure per tank (Rs.)	Average area benefited per tank (acres)	Average expenditure per acre (Rs.)
(1)	(2)	(3)	(4)	(5)	(6)
Andhra@ .. ..	1956-57 to 1960-61	217	11,493	89	129
Kerala@ .. ..	1959-60 to 1960-61	107	6,635	21	320
Madras .. ..	1956-57 to 1960-61	2,120	21,945	104	211
Maharashtra ..	1952-53 to 1960-61	53	72,200	317	228
Mysore .. ..	1951-52 to 1960-61	2,775	4,966	30	164
Rajasthan .. ..	1951-52 to 1959-60	275	40,734	844	48
W. Bengal .. ..	1951-52 to 1960-61	3,034*	4,806	44	110

@The data relate to only one district in the State, Warangal in Andhra Pradesh and Trivandrum in Kerala.

\*Includes 43 tanks restored in 1960-61 for which expenditure figures were not available. The data in other Cols. are based on 2991 tanks.

6.14. The average expenditure on restoration per tank has varied from Rs. 4,806 in West Bengal to Rs. 72,200 in Maharashtra during the recent period. Since the tanks vary in size, the area benefited from restoration is not the same in each case. The average area benefited per work is highest (844 acres) in Rajasthan and lowest in Kerala (21 acres). It is because of these variations that meaningful comparison can be made only in respect of the cost per acre of the area benefited. The relevant data are given in col. 6 of Table 6.1. The cost ranges from Rs. 320 in Kerala to Rs. 48 in Rajasthan. A number of factors lie behind these variations, constructional features of the tanks, physical features of the terrain, type of soil, price of land and wage rates. For Mysore, the area benefited from restoration per tank comes to 30 acres and the cost per acre to Rs. 164. These actuals based on past data may not necessarily reflect the level of cost in future, which may rise as restoration is extended to the poorer and worse neglected tanks.

6.15. For Kerala the cost of restoration per acre of irrigable area of the tanks comes to Rs. 320, as given in Table 6.1. It may be added that the figures supplied by the Kerala Government on costs of, and area expected to be irrigated from the restoration of tanks show the cost per acre as about Rs. 400. Because of the relatively bad state of silting of the tanks and the immense magnitude of work involved in restoration, the level of costs seems to be rising.

6.16. Data in Table 6.1 also show that in Madras and Mysore the work of restoration has made good progress. The number of tanks restored per year in the recent past comes to 425 in Madras and 278 in Mysore and the corresponding expenditure to Rs. 93 lakh and Rs. 13.7 lakh respectively. It may be added here that in Madras a total of 4,758 tanks have been restored since the beginning of the First Plan. But, when the amount of work done so far is compared with the total backlog that remains to be done, it appears that only the fringe of the problem has been touched. The summary figures in Table 6.2 give the picture at a glance :

TABLE 6.2

*Position regarding Restoration of Tanks in Madras and Mysore*

State						Total No. of tanks	No. need- ing restora- tion by 1961	No. provided for restora- tion in the Third Plan by (1965-66)
(1)						(2)	(3)	(4)
Madras*	..	..	..	..	..	27,444	6,630	5,000
Mysore	..	..	..	..	..	37,300	14,000	5,000

\*Supplied by the Board of Revenue, Madras.



It may be noted that the rate of restoration proposed for the Third Plan period is the same in Madras and Mysore, 1,000 tanks per year on an average, though the number needing restoration in 1961 in Mysore was nearly two and a half times that in Madras. It is only in Madras that restoration work seems to have made relatively good progress and will, to a large extent, be catching up with the backlog. In Mysore, the position is far from satisfactory. While we have not been able to collect similar quantitative data for other States where tank irrigation is important, our general impression is that the situation in these States is far from satisfactory.

#### DESILTING-CUM-RECLAMATION PROJECTS

6.17. The latest development in the field of tank restoration and improvement is desilting-cum-reclamation. The Madras Government have taken up these operations as special projects. The scheme is designed to restore the lost capacity of the silted tanks by desilting their beds through the use of earth-moving machinery and/or by raising their embankments to full tank level wherever feasible. The scheme was launched initially in selected areas on an experimental basis and has been in operation in North Arcot, South Arcot, Ramnad and Kanyakumari districts and in the Pudukkottai area in Tiruchirapalli district. Forty-seven desilting-cum-reclamation projects have been completed during the Second Plan period. Three of the 'continuation' works and 73 new works are expected to be executed in 1961-62 at an estimated cost of Rs. 15 lakh. A sum of Rs. 80 lakh has been provided in the Third Plan for such works.

6.18. The Mysore Government, following the recommendation of the Report of the COPP Study Team on Minor Irrigation, have also taken up experimental projects on desilting-cum-reclamation with a view to (i) making available more water from the heavily silted tanks for agricultural use and (ii) making available more land out of the foreshore of the beds of tanks. Two projects taken up were on the Hebbal tank and the Sulebele tank. The cost of the Hebbal project has been estimated at Rs. 60,000 and that of the Sulebele scheme at Rs. 12,25,000. The works were started in April, 1959 and are almost complete. The results achieved are (i) about 39 acres of fertile land in the tank-bed has been reclaimed out of which 16 acres are already fit for cultivation, (ii) two approach valleys have been canalized with channels, and silt pits have been dug all along the inlet channel to arrest the silt. In the case of Hebbal tank, the cost of reclamation per acre comes to about Rs. 1,500. The experiments so far conducted, tend to show that the desilting-cum-reclamation operations are advisable, at least in Mysore, in those cases where the tank-bed (water spread area) is large as compared to its ayacut, and the cost of surrounding land high. It does not seem possible yet to say that these schemes can be taken up as sound financial propositions. They can be taken up as a subsidised Grow More Food Campaign item, for the purpose of reclaiming fertile agricultural lands lying unused for a large proportion of the area. With proper crop planning, the tanks which have been neglected for long, can be brought under the Tank-bed Plantation programme for community use.

#### REPAIR AND MAINTENANCE OF TANKS

6.19. It has been pointed out that restoration, improvement and desilting operations are in the nature of capital projects and stand in a different category from what are called regular repair and maintenance operations. The

latter include inspection of tanks and repair of breaches or weak spots in the embankment, repair of sluices and waste weirs, desilting and clearing of field channels, and clearing of weed. Labour is the main item required for these operations, which are not usually needed every year, though annual inspection is probably imperative. In addition to these normal and periodical maintenance operations, there are repairs needed occasionally to plug breaches in embankments caused by cyclones, or abnormally heavy rainfall. The periodicity of the maintenance operations is not the same in all areas and may be linked with the life-time of the works. In Andhra, the average life-time of tanks is usually placed in the 50—75 year range and in Kerala in the 100—150 year group. In Madras, however, a tank if properly maintained, can serve the purpose of irrigation for an indefinite period.

6.20. The periodicity of maintenance operations in different areas is fixed in terms of cycles of varying length. Information collected from the State Governments shows that in Andhra and Madras, the 'circle' system is followed for attending to the maintenance operations. Under this system, each taluk is divided into 5 or 6 convenient circles where maintenance operations are taken up successively in different years. The staffing pattern of irrigation supervisors and overseers is so arranged as to ensure inspection of, and repair work on each tank at least once in 5 or 6 years. The advantage of the system lies in the fact that the area to be attended to is fixed in such a way that all the works are looked after in the course of a complete cycle. Repairs are attended to, and restoration work planned where needed. Moreover, while the execution of the repair and restoration operations goes on in one circle, the preliminary planning and investigation work is undertaken in an adjacent circle. The 'circle' system seems to have worked satisfactorily in these States. Care is to be taken, however, in the 'circle' system to ensure arrangements for detecting and attending to ravages of flood, cyclone, etc., as and when they occur. This 'circle' system does not seem to be followed as a matter of policy and procedure in other States like West Bengal. There is obviously much to be said in its favour, as long as it does not become too rigid and inflexible.

6.21. It has been shown in Chapter III that the majority of the tanks in 1959-60 were Government owned. With the progress of land reforms, tanks in those States where these had been previously owned by large farmers or zamindars, came to vest with the State. In the southern States, however, many of the tanks had even in the earlier days been owned and managed by the Governments through their concerned departments. The maintenance of the tanks had therefore, become a charge on the revenues of the State Governments. Provision is generally made for this activity in the budget of Departments like Revenue and Irrigation (P.W.D.), according to their responsibility in this matter. Complaints have often been heard regarding inadequacy of financial provision for maintenance. This might have arisen in those States where the budget provisions did not contain separate allocations for new construction of minor irrigation works and for their maintenance, with the result that the latter often suffered more than the former. In some States, however, as in Orissa and West Bengal, there had been separate allocations. But even in these States, the allocation for maintenance has not been adequate. For example, in West Bengal, only 10% of the initial cost of a tank is earmarked for maintenance for a period of 20 years, which works out to an annual provision of  $\frac{1}{2}\%$  of the original cost. This is rather meagre. Further this 10% provision need not be spread over the whole

period and can be spent within a few years, after which the Department is unable to incur any further expenditure. Recovery of water rates is also very poor and in heavy arrears. There is no separate allocation of funds for repairs to embankments in Assam, as has been pointed by the Embankment and Drainage Projects Reviewing Committee. There is a strong case for prescribing a certain minimum annual provision for repairs to tanks and other works, in addition to special grants for repairs when necessary to ensure proper maintenance. The practice of allocating funds as a proportion of the original cost of the works often results in inadequacy of funds, because of the rise in the level of costs and prices in the intervening years. For works undertaken by the Government, regular maintenance levy may be imposed on lands irrigated by them.

#### MAINTENANCE OF WELLS

6.22. *Wells Out of Use.*—It has been pointed out in Chapter III that nearly 8% of the pucca wells in our sample were not in use at the time of enquiry in 1960-61 for various reasons, the corresponding proportion for kutchha wells being about 17%. Thus, proportionately, more of the kutchha wells located in the sample areas in 1960-61 were out of use than of pucca ones. The distribution of these wells by their physical condition is given in Table 6.3.

TABLE 6.3

#### *Percentage Distribution of Wells Out of Use by Physical Condition*

Physical condition								Pucca wells	Kutchha wells
(1)								(2)	(3)
Old and abandoned	..	..	..	..	..	..	..	10.0	—
Collapsed	..	..	..	..	..	..	..	1.4	90.5
Silted up	..	..	..	..	..	..	..	23.6	
Inadequate water	..	..	..	..	..	..	..	11.4	0.9
Others with water	..	..	..	..	..	..	..	53.6	8.6
TOTAL	..	..	..	..	..	..	..	100.0	100.0

It appears from these data that 65% of the pucca wells which were not in use, were so even though water was available in these, whatever its quantity. Among kutchha wells, however, the corresponding proportion was very low, about 10%. About 90% of the kutchha and 35% of the pucca wells out of use were thus not in an usable condition, having either collapsed or silted up or been abandoned. In the case of kutchha wells in alluvial areas such collapse cannot be prevented because their life-time is short, though it can be slightly prolonged through regular care. The life of pucca and kutchha wells in rocky areas can, however, be extended considerably through proper maintenance. It is the neglect of such maintenance that often causes the wells to go prematurely out of use.

6.23. The fairly high proportion of pucca wells containing water but having gone out of use presents an anomaly, and requires some examination.

**TABLE 6.4**  
*Percentage Distribution of Wells With Water, Gone Out of Use by  
Reasons for Being Out of Use*

Reason	Pucca wells	Kutchra wells
(1)	(2)	(3)
Salinity of water .. .. .	16.5	—
Availability of water from tube-wells .. .. .	18.6	—
Non-cooperation among the owners .. .. .	17.6	—
Location far off or at low level .. .. .	6.6	9.5
Prefer dry-farming .. .. .	3.3	—
Inadequate water .. .. .	17.6	9.5
Miscellaneous .. .. .	14.3	81.0
No reason .. .. .	5.5	—
<b>TOTAL .. .. .</b>	<b>100.0</b>	<b>100.0</b>

An attempt has been made in Table 6.4 to analyse the reasons for these wells going out of use. From the data in this table, it appears that 17% of the pucca wells were not in use because of the salinity of water in them. Most of these wells have been found in the sample villages in blocks in the Dhulia district of Maharashtra. Another 19% of the pucca wells were not being used because water from the State tube-wells was available in the locality. These wells are located in the sample villages in the Patiala district of Punjab. The other important reasons are non-cooperation of the owners and inadequate supply of water. Of the reasons found for such wells not being in use, all but one relate to the physical or the locational factors. Only one, namely, non-cooperation among the owners is a problem of a socio-economic nature. This is the type of problem that arises mainly when there are co-sharers owning a well. Since the proportion of kutchra wells having water, yet remaining out of use is very low, there is no point in trying to analyse the reasons for their non-use. It appears from this analysis that most of the important reasons responsible for wells with water remaining out of use are of a physical nature beyond the control of the owners themselves. Only in a small proportion of the cases there is scope for extending their use through mutual arrangement or understanding among the owners.

#### SILTING OF WELLS

6.24. The reduction in the capacity of a well depends on the rate at which silting or filling up takes place. In the case of kutchra wells the rate of silting or filling up is comparatively high. Desilting of a well is difficult to carry out, if the sub-soil is hard and the well is deep. Gradually the wells go out of use. This problem in some areas is quite serious. In Badnawar block of Dhar district, Madhya Pradesh, a growing number of wells is falling into disuse, even though there is a shortage of irrigational facility. Many of the wells constructed to encourage opium cultivation in the former Dhar State are now badly silted up and are in worn out condition. Most of these wells have not been repaired since the merger of this State. Repairs by beneficiaries have also been inadequate or completely neglected. In the case of the big wells which irrigate lands of a few families, cooperation of all the owners in the work of desilting is not always forthcoming, as has been indicated by the figures in Table 6.4. The result is a gradual increase in the number of derelict wells. In another selected block in the

Dhar district, one-third of the wells existing in 1959-60 were found to be abandoned. Abandoned wells have gone up by 44% since 1955-56, and has reduced the net increase in irrigating wells to only 11%, as the following figures will show :

	1955-56	1959-60	Percentage
Total no. of kutchha wells	1,874	2,287	22
No. of irrigating wells	1,257	1,398	11
No. of abandoned wells	617	889	44

6.25. At this rate, there will soon be a net decrease in irrigated area. In fact, some data on Government wells could be obtained for one circle out of the two in another block of the district. These are given below :

	1957-58	1959-60
No. of Govt. wells irrigating	147	143
Area irrigated (acres)	741	628
No. of abandoned Govt. wells	113	153

The number of irrigating Government wells has gone down since 1957-58 while that of abandoned Government wells has gone up. As new wells are being dug, old ones are being abandoned in greater numbers in this area, thereby resulting in a decrease in irrigated area. It appears that in this area very few families undertake full scale desilting. The shortage of funds and of labour as well as the lack of initiative aggravate the problem of silting. In the case of kutchha wells, the upper portions become widened necessitating remodelling; but repairs are hardly taken up. Due to the rocky soil, construction of pucca wells is costly. In a substantial number of cases in the area, blasting or boring operations are necessary to increase the capacity of the wells. Indigenous methods of blasting and boring are prevalent, but use of air compressors will be more effective which in some blocks, however, are not always available in sufficient number. Shortage of equipment and technical personnel stand in the way.

6.26. We have discussed at length the problems of maintenance of wells that have been noticed in one of our sample districts in M. P., mainly because they show the gravity of the situation. The position may not be as bad in other areas. It is, however, difficult to give a precise quantitative picture of the condition of different types of wells, and the state of their maintenance. Wells are smaller works, more numerous than tanks and correspondingly more dispersed. Most of them are privately owned; and the responsibility for maintenance is essentially on the owner. Besides, there is no arrangement for the inspection of wells by any official or local agency to assess their physical condition and the state of maintenance. The nature of the maintenance operations on the wells is, however, fairly well-known. Desilting is necessary at intervals, the repairs to the upper portion of the platform and the lift arrangements in the wells have to be attended to when necessary. But the nature and frequency of such operations vary from area to area, depending upon the soil, the rockiness of the strata, and other factors. The objective of the maintenance operations is not only to keep the structure of the well in a durable and safe condition but also to ensure an adequate flow of the percolation water or spring. It is not easy to state very specifically the types of maintenance operations that are needed on kutchha wells, as distinct from those necessary for the pucca ones. As has been pointed out in Chapter III, the distinction between the kutchha and the pucca wells even in the same region in a State differs from district to

district. Besides, a kutchha well with a rock bottom will have a much longer life than a kutchha well in an alluvial region. There is also the third aspect of the maintenance of wells, namely, the repair and servicing of the lift arrangements like persian wheels, pump sets, etc. installed on the wells. The use of these mechanical devices have raised some problems that are referred to in the next paragraph.

6.27. *Equipment and Repairing Facilities.*—The use of diesel and electric pump sets for lift irrigation and of boring and blasting machines in the excavation and deepening of wells, is on the increase. This has brought in its wake important problems relating to the installation, proper maintenance, repairs, servicing facilities and supply of spare parts. While minor repairs are in most cases carried out by the village blacksmiths and their counterparts, the farmers sometimes face considerable difficulties in having major repairs done and in securing spare parts. It appears from the data collected from the farmers in the sample that 39% of the respondents had repair facilities within their village, 22% had these at a distance between 1 to 5 miles, while the remaining 39% had to travel more than 5 miles for getting their pump sets, etc. repaired. In none of the sample blocks, common facility workshops have been found to exist. It is only in a couple of blocks that mobile units are provided. In most of the blocks, the number of pump sets, boring machines, etc. is too small to justify the setting up of a common facility workshop. The provision of such facility will be of great help, particularly in blocks located away from the urban areas. No arrangements for providing technical training to the cultivators in handling engines and equipment have been reported from the sample blocks, except some half-hearted approach in a couple of blocks.

6.28. *Financial Assistance for the Maintenance of Wells.*—Since wells are usually privately owned, the financial burden of their maintenance falls necessarily on the cultivators owning them. There has been provision, however, under the Land Improvement Loans Act for taccavi loans for the construction and maintenance of wells. With the initiation of the Community Development programmes, funds were provided in the Block budget for the grant of loans and a certain amount of subsidy for the construction of wells by the beneficiaries. No separate provision seems, however, to have been specifically made for the grant of loans for the maintenance of wells. Our general observation is that loan facilities made available to the cultivators have been much more for construction purposes than for maintenance. This will be clear from the data given in Table 6.5. The amount and proportions of financial assistance (F.A.) given for construction of wells (in use) have been shown separately from those for their maintenance in the sample areas selected for the study.

TABLE 6.5

*Financial Assistance for the Construction and Maintenance of Wells*

Item	Pucca wells	Kutchha wells
(1)	(2)	(3)
1. Wells in the sample as on 1960 (No.) .. .. .	1,551	1,684
2. Average cost of construction per work (Rs.) .. .. .	1,821	1,150
3. Wells which received financial assistance (F.A.) for construction till 1960 :		
(a) No. constructed .. .. .	169	5
(b) Percentage constructed to total existing .. .. .	11	3
(c) Average F.A. per work for construction (Rs.) .. .. .	978	790
(d) Percentage of F.A. (for construction) to total cost of construction .. .. .	54	69

(1)	(2)	(3)
4. Wells which received F.A. for maintenance till 1960 :		
(a) No. of wells .. .. .	36	10
(b) Percentage of such wells to total existing .. .. .	2.3	0.6
(c) Average F.A. per work for maintenance (Rs.) till 1960 (cumulative) .. .. .	637	450
(d) Percentage of total F.A. (for maintenance) to total cost .. .. .	44	135
(e) Percentage of annual expenditure on maintenance to total cost .. .. .	17	Nil
(f) Annual expenditure on maintenance (Rs.) .. .. .	267	—

In interpreting the figures of financial assistance on maintenance given in Table 6.5, it should be noted that these relate to the total amount received from Government sources till 1960 and do not represent annual provision.

6.29. The number of pucca wells that had received financial assistance was 205 or 13.3% of the ones existing in 1960. Of these, only 36 or about 18% received financial assistance for maintenance. Thus, financial assistance reached only about 2% of all the pucca wells in the sample and even for these the assistance amounted to only 44% of their total cost, while the annual expenditure on maintenance worked out to 17% of the total cost. The wells which received such aid are located in different States. The data go to show that the overall financial aid for maintenance has been very little. The figures for kutchha wells tell the same story in a still more pointed way. Only 10 wells out of a total of 1,684 or 0.6% received some assistance for maintenance. Practically all of these wells are located in the sample blocks in Dhar district, Madhya Pradesh. This was, however, because of the special nature and history of these wells, which has already been described. Apart from these, no other kutchha well in our sample had received any financial assistance.

6.30. Besides the inadequacy of financial assistance, there is also the question of proper utilization of financial aid. It has not always been true that the aid given was actually used for the purpose of construction or maintenance of the works. In Badnawar blocks of Madhya Pradesh, such assistance was reported to have been used for consumption purposes.

#### GENERAL PROBLEMS OF MAINTENANCE OF MINOR IRRIGATION WORKS

6.31. We have so far described the operations needed for the maintenance of tanks and wells separately, analysing the adequacy of such operations both in their physical and financial aspects. There are, however, a number of other problems associated with the maintenance of minor irrigation works. The more important of these relate to the administration and management of these programmes, which will be taken up in Chapter VII. Some of the other problems of a general nature relate to the shortage of technical personnel, the effect of land reforms, and the role of the beneficiaries. These will be taken up in the remaining part of this chapter.

6.32. *Shortage of Technical Personnel.*—The progress of maintenance work on minor irrigation works, particularly those managed by the Government, seem to be suffering in a number of States from shortage of technical personnel. In some States, there is a shortage of qualified engineers and overseers not only in the Revenue but also in the Development Department. In some States, even the Irrigation (P.W.D.) Development is reported to have

been suffering from shortage of technical staff. Lack of technical competence is reported also on the part of the contractors who tender for the works. The problem is not easy of solution, particularly because it is connected with the country-wide shortage of engineering personnel. We may, however, refer in this connection to an attempt made by the Orissa Government to solve this problem by creating a pool of technical staff. Under this scheme, two districts are generally placed in the charge of an Executive Engineer (under whom there are Assistant Engineers and Overseers) who is under the administrative control of the Revenue Divisional Commissioner when stationed at Divisional Headquarters, otherwise under the Collector. One team consisting of one Executive Engineer, two Assistant Engineers and four Overseers is under the Deputy Development Commissioner (minor irrigation). For each block under the intensive programme two Overseers are provided and one Assistant Engineer for each Special Multipurpose Block. These staff are under the control of the Planning and Co-ordination Department. In fact, under this scheme, the services of engineering personnel of different ranks are placed as needed at the disposal of the Commissioner, the Collector, the Sub-divisional Officer and the Block Development Officers for all engineering work required under the development programme of all departments and agencies. Funds for the pay of staff etc. in the pooled scheme come from the funds provided by the different departments handling minor irrigation programmes. The staff of the pooled scheme is responsible for the inspection of the irrigation works but no periodicity is provided.

#### EFFECT OF LAND REFORMS ON MAINTENANCE

6.33. Prior to the abolition of intermediaries like zamindars, jagirdars, malguzars and inamdars, the irrigation works, mostly tanks and miscellaneous works like ahars, pynes, etc., used to be maintained by the intermediary right holders, though not always up to the desired standard. In the course of time, however, these works came to be neglected, particularly in the later period when legislations on land reforms were engaging the attention of the State Governments. With the abolition of the intermediaries, the State Governments have been facing the formidable task of restoring the long neglected works and maintaining them efficiently.

6.34. Some of the States have not so far been able to chalk out any special system for this category of works. In the absence of proper investigation, and on account of the general limitation of resources, maintenance of such irrigation works has got a temporary set back. Many of these works require heavy initial outlay for renovation, presumably because this maintenance was neglected by the owners anticipating their acquisition. In many areas, however, water rates are not derivable from these works, and the cultivators also are not used to paying water rates for irrigation from these works. These factors have combined to make their maintenance apparently not immediately paying to the Government. Reports from some blocks suggest that clear-cut instructions did not exist as to which departments were to undertake such works, with the result that their maintenance had suffered further.

6.35. A considerable proportion of the tanks previously owned by the zamindars and other landlords was not scientifically constructed; and in some cases there had been wasteful exploitation of the water potential. These require to be standardized, involving much initial expenditure which the State Government may be able to only gradually. In some State



where consolidation of holdings has been undertaken, adequate provision does not appear to be always made for making maps of alignment of field channels and water courses in advance and taking them into account at the time of the consolidation operations. This has sometimes resulted in an uneven sharing by the concerned farmers of lands needed for the irrigation channels.

6.36. One of the problems that arose immediately after the taking over of the zamindari tanks by the State Government, related to the transfer of these works to the concerned Department. This transfer seems to have been effected in some States. The Rajasthan Government have transferred tanks irrigating below 50 acres to Panchayat Samitis. In Madras, the ex-zamin tanks are treated as a special category; and a new unit has been created to look into their problems and ensure a quick improvement of these tanks. In some of the States, however, the tanks are still lying unattended with the Revenue Department. In the meantime, they are getting silted up.

6.37. The task of restoring the long neglected irrigation works now vested in the State as a result of land reforms seem to have strained the resources of the State Governments to a considerable extent. Most of the States have not yet been able to take up the standardisation and improvement of irrigation works with speed and urgency because of the shortage of funds. Though it is not possible to know the exact amount of Block fund spent on such works, because no separate accounts are maintained, it is reported that in almost all cases the provision has fallen short of the requirements.

#### ENFORCEMENT OF STANDARDS

6.38. Inadequate finance is a bottleneck not only for ex-zamindari works but also for other works, as mentioned earlier. But it is not always the lack of provision that stands in the way. Sometimes the schemes do not go through because they do not satisfy the prescribed standards.

6.39. While it is necessary in sanctioning schemes to enforce a minimum standard of physical achievement in terms of rupees spent, care is to be taken to see that rigid imposition of such standards in a stereotyped fashion does not hamper the programme or slow down the tempo of work. Some of the field reports give ground for such apprehension. For example, in West Bengal, the Tank Improvement Department could not get many projects sanctioned, because previously the State Government examined the costs of the schemes against a fixed standard of Rs. 100 per acre of the area benefited, irrespective of the general level of costs and prices. The practice of prescribing a ceiling on expenditure on a per acre basis tends to encourage the practice of showing inflated figures of area benefited and thus to reduce the cost per acre. In most States the jurisdiction of various departments for restoration of works or undertaking new works is also fixed according to either the irrigated area or cost per acre or both. This tends to encourage to departmental rivalry as well as departmental bias in reporting figures.

#### ROLE OF BENEFICIARIES

6.40. The role of the beneficiaries in respect of maintenance of minor irrigation works is not adequately realized by the people. As a result, the repairs get neglected and the works tend to go down in efficiency. One of

the reasons for this state of affairs is that legislation in this respect is not pointed enough. But even where provisions exist, they have remained on the statute book. No serious attempt has been made to enforce them.

6.41. In Mysore, the responsibility for the maintenance of tanks, whether major or minor, rests with the ryots; and the duty of enforcing this responsibility devolves upon the Revenue Department. The obligation of villagers in this connection has been defined in the rules framed as far back as in 1886 and reiterated from time to time. These have been incorporated in the Irrigation Act passed in 1952. This Act provides for customary labour by beneficiaries for the maintenance of minor irrigation works. The duties of the beneficiaries are confined to earth work, filling in scours, etc., whereas repairs to masonry work in waste weirs, irrigation sluices, stone revetment, are to be carried out by the P.W.D. In some cases, the ryots share in the repair expenses was limited to only one year's revenue, the rest being borne by the Government. It is, however, within the discretion of the Deputy Commissioner to fix the proportion of the cost to be recovered from the beneficiaries.

6.42. In Madras, the Madras Compulsory Labour Act, 1858 also called the Kudimaramath Act—provides for the levy of compulsory labour for the prevention of destructive inundation and for the enforcement of customary labour on certain works of irrigation in the State. The Act provides for calling upon able-bodied persons in a village at times of emergent repairs required to be done on tanks, anicuts, canals etc. to save them from breaches. Where the customary obligations were not discharged, the necessary works could be carried out by the Tehsildar and the cost apportioned among the landholders and recovered from them as arrears of land revenue. This Act also applies to Andhra Pradesh including the Telangana region. To facilitate the actual execution of repairs to tanks under the charge of the Revenue Department, the departmental authorities right down to the village headman are empowered to conscript the necessary labour from the local residents. The provisions of this Act were used to get maintenance work done on tanks on a large scale upto the thirties of this century. Since then, it has been enforced only sparingly. There are, however, certain difficulties in making use of the provisions of this Act under the present conditions. Further, the Madras Panchayats Act, 1958 makes it possible for the Panchayat or the Panchayat Union Council to take over the customary obligation, discharge it and meet the cost by levying a statutory fee for the purpose. The Panchayat Act also provides that this assumption of responsibility by the panchayat or the Panchayat Union Council does not exempt the landholders from liability to enforcement of the rules by the Tehsildar in the event of the panchayats or the Panchayat Union Councils failing to discharge the obligation assumed by them.

6.43. In order to prevent the customary obligations from lapsing by disuse, a record should be maintained by the Panchayat Union Commissioner specifying the existence of customary obligations and their precise nature in respect of each source for which these existed. At present two registers are maintained in the Tehsil records viz., (i) the Kudimaramath register for the Taluk with a page for each village and (ii) a register showing penalty recovered under the Act and its disposal. The State Government have directed that these two registers should also be maintained for every Panchayat Development Block by the Panchayat Union Commissioner

concerned after such modifications as the Board of Revenue may consider necessary.

6.44. In Maharashtra, the Bombay Irrigation Act makes it obligatory on the part of the beneficiaries to maintain certain irrigation works and field channels. In the event of any default, the works can be carried out by the Government and the cost recovered from the beneficiaries. In actual practice, however, not much use has reportedly been made of this provision. The Bombay Irrigation Act also applies to Gujarat. But, as in Maharashtra, in actual practice little use is said to be made of this provision. The State Government is reported to be considering the question of empowering the panchayats to enforce this statutory obligation on the beneficiaries for the maintenance of irrigation works. If the latter fail to carry out the work in time, the panchayat should carry out the work and realise the cost. In the event of the panchayats failing to carry out the work, the Government or, on its behalf, the Panchayat Samitis or the Block may arrange for the execution of works and recover the cost from the beneficiaries concerned. A proposal is reported to be under the consideration of the Government to amend the Bombay Irrigation Act to this effect.

6.45. In Madhya Pradesh, under the Irrigation (Amendment) Ordinance, 1960, any permanent holder or occupier of irrigable land may be required to construct field channels for irrigation from canals as well as all other works. If more than one-half of the permanent holders of the benefited land agree, the work of construction may be undertaken by the Government on their behalf, and the cost recovered from them. They are also responsible for (i) maintaining properly the field channels so constructed, and (ii) constructing and maintaining all works necessary for passage across such field channels, etc. If the maintenance is not properly done, the Government may undertake necessary works and recover the cost from the landholders.

6.46. In West Bengal, the Bengal Tank Improvement Act, 1939, amended in 1948, empowers the District Magistrate to take up any tank for improvement which, in his opinion, has fallen into disrepair or disuse. In the first instance, the person or persons owning the tank are given an opportunity to carry out such improvement of the tank as the Collector considers necessary for the proper utilization of the tank for irrigation. If the owner does not carry out the improvements within a specified time, the Collector declares it to be a derelict tank and takes control of it for a maximum period of 25 years after which the tank has to be handed over to the owner. The Collector gets the improvement work done and recovers at least 50% of the cost from the beneficiaries through annual levies spread over 20 years.

#### SUMMARY

6.47. Among the problems connected with the physical side of maintenance, silting is more important for tanks, particularly in areas like Kerala, Andhra and Madras. The annual reduction in capacity because of silting in these States is estimated at about 3%, 1.3 to 2% and 1% respectively. These figures could be obtained for a few States only. All State Governments do not seem to be following the practice of estimating the net annual position regarding the irrigable capacity of tanks. In fact, it is doubtful if the States try to collect scientifically data for this netting

process. On the other hand, the problem of silting and of abandoned wells is quite serious in areas like Dhar district, Madhya Pradesh. Shortage of funds, of equipment for boring and even of labour aggravates the problem. While wells are generally not in use because of physical conditions or locational factors, tanks get silted up because maintenance operations are not done periodically. Only in Andhra and Madras, the 'circle' system is followed for attending to the maintenance operations, which ensures inspection of and repair work on each tank at least once in five or six years. This system does not seem to be followed as a matter of policy in other States, though there is much to be said in its favour. Only additional precaution is to be taken to plug breaches etc. caused by abnormal rainfall or cyclones as and when they occur.

6.48. In general, financial assistance made available to the cultivators has been much more for construction purposes than for maintenance. The inadequacy of assistance for maintenance has arisen partly because in the past the budget provisions did not contain separate allocations for maintenance, with the result that these operations often suffered more than the construction of new works. Besides, with the abolition of intermediaries like zamindars, the State Governments have been facing the formidable task of restoring their long-neglected works. For these works the cultivators are not used to paying water rates, which has made the problem more complicated.

6.49. The minor works are so multitudinous in number and so widely scattered that a solution of the problem of their proper maintenance has to be thought of more in the direction of emphasizing the role of beneficiaries themselves than in their looking forward to the Government for help. At present, cultivators do not realize adequately their own role in respect of maintenance. One of the reasons for this state of affairs is that legislation is not pointed enough; but even where provisions exist, they have often remained merely on the statute book and were not enforced even though the situation justified enforcement.

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## CHAPTER VII

### ADMINISTRATIVE AND ORGANISATIONAL PROBLEMS

7.1. In the course of our discussion of the problems<sup>o</sup> of extension and maintenance of minor irrigation, we have often referred to administrative and organisational difficulties. The problems are many and long standing, and are, therefore, not very easy of solution. Some of these were there even in the twenties, as is borne out in the Report of the Royal Commission on Agriculture (1928). Our objective in this chapter is to raise the administrative and organisational problems which stand in the way of speedy and efficient working of the minor irrigation programme, and to analyse the steps that have been or are being taken to cope with them. For convenience in understanding and presentation, the problems are grouped under the following heads :—

- (1) Problems of co-ordination among the different agencies handling minor irrigation programmes;
- (2) Problems relating to the panchayats and labour cooperatives;
- (3) Land acquisition problems;
- (4) Problems relating to contractors; and
- (5) Shortage of technical personnel.

#### PROBLEMS OF CO-ORDINATION

7.2. The Sixth Conference of Development Commissioners (1957) recommended that each State Government should have one senior irrigation engineer entrusted with the task of planning and co-ordinating irrigation schemes of all departments, and maintaining liaison with the Development Commissioner. The 1958 Conference suggested that in the pre-extension stage of a block, the Irrigation, Agriculture and Planning Departments should jointly survey and assess the irrigation potential in a block and decide upon the allocation of minor irrigation funds under the different categories, private and State works. After this is done, the amount earmarked for State managed works should be placed at the disposal of the Department in charge of such irrigation works. The Conference held at Srinagar in June 1960 went a step further to recommend that there should be a unified agency in each State for the handling of minor irrigation programmes financed from various sources. It is obvious that great stress has been laid in the last few years on co-ordinated planning, execution and maintenance of minor irrigation schemes.

7.3. Problems of co-ordination are particularly serious in the field of minor irrigation, because there are usually more than one agency or department responsible for the execution and maintenance of these works in each State. The administrative arrangements for, and the nature of the minor irrigation programmes show a wide diversity among the States, as will be apparent from the details of the agencies operating, given in the statement in Appendix B. This also gives an idea of the machinery set up in some of the States for bringing about administrative co-ordination.

**7.4. Minor Irrigation Directorate or Cell.**—Separate minor irrigation Directorates are reported to have been set up in three States viz., Orissa, Maharashtra and Bihar. In Orissa, the Directorate is headed by the Deputy Development Commissioner who is under the Planning and Co-ordination Department. In Maharashtra, the Directorate is under the State Irrigation and Power Department. The Directorate is charged with the responsibility of planning, execution and design of minor irrigation works. The Bihar Government has set up a full-fledged wing headed by a superintending engineer who is designated Additional Director of Agriculture (Engineering) and is under the administrative control of the Secretary of the Agriculture Department. It may be relevant to add here that the Srinagar Conference of Development Commissioners (1960) cited the example of Bihar and implicitly endorsed the idea of the Directorate being in the Agricultural Department under the administrative control not of the Director but of the Secretary. To that extent, the set up in Maharashtra as well as in Orissa does not conform to the expected pattern—one being under Irrigation and Power and the other under the Planning Department. Which Department can serve best as the co-ordinating agency for minor irrigation works, remains a moot question that needs further examination. The data thrown up by our enquiry are not sufficient to enable us to crystallise views on this issue. As the Directorates have only recently been created, it is perhaps too early to examine the effectiveness of their location in relation to the three Departments—Agriculture, Irrigation and Planning and Development.

**7.5.** It is pertinent, however, to add that the Nalagarh Committee (1958) had recommended the setting up of a Works Division within the Directorate of Agriculture for the execution of the minor irrigation programmes within the agricultural sector. The Committee did not favour the Irrigation or Public Works Department, and held that "this department cannot be expected to give as much importance to minor irrigation works as it does to its regular work of much bigger dimension. A department which is handling a project like the Bhakra Dam, can hardly be expected to pay much attention or importance to a minor 'Kuhl' in, say, the Kangra district<sup>1</sup>". The apprehension seems real; and there does not seem to have been any new development to justify taking a different line. Creation of a separate Directorate or Cell in the P.W.D. or Irrigation Department will no doubt act as a check to the tendency of major works dwarfing the growth of minor works; but to what extent this check will operate remains yet to be seen. The angle of the ultimate user, again, points in the direction of the Agricultural Department. In fact, this line of recommendation has a long history and goes back to the Royal Commission on Agriculture.

**7.6.** Besides the three States mentioned above, Madhya Pradesh has a minor irrigation Cell at the Chief Engineer's level, headed by a Superintending Engineer (Minor Irrigation). It was created two years back. The Superintending Engineer (Minor Irrigation) is responsible for guiding and conducting the minor irrigation programmes at all levels in the field. The Government have created 34 minor irrigation sub-divisions in the State which are exclusively engaged on this work. No other State have set up directorates or cells of minor irrigation as these four States.

**7.7. Boards and Working Groups.**—In a few States, co-ordination is being attempted through boards and working groups. In the Punjab, a Minor Irrigation Board has been set up in June, 1960 to co-ordinate the schemes

<sup>1</sup>Report of the Agricultural Administration Committee, Ministry of Food and Agricul-

of Agriculture and Irrigation Departments relating to minor irrigation works. It is reported that the State Government is also considering the appointment of an officer of the status of Superintending Engineer in the Agriculture Department to look after all minor irrigation works in the State. In Bihar, the State Development Commissioner is the Chairman of the Working Group and the Chief Engineer (Irrigation) is its convenor. In Rajasthan, a State level Co-ordination Committee has been set up with the Development Commissioner as Chairman and Secretaries of concerned Development Departments as members, while in U.P. there is a State level Campaign Co-ordination Committee, presided over by the Chief Minister. In Maharashtra, there is a Water Utilization Committee which in turn has appointed from among its members a Standing Committee to review the problems of minor irrigation. In Gujarat, the minor irrigation programmes at the State level are co-ordinated through a Sub-committee of the State Development Board, consisting of the Chief Engineer and representatives of the Agriculture, Development and other Departments. For Mysore, the Committee on Plan Projects had recommended the creation of a special wing in the P.W.D. so that concerted efforts could be made for the regular inspection, maintenance and timely execution of all minor irrigation works in the State. The creation of a separate whole-time minor irrigation staff in the P.W.D. from the State level downwards and integrating this staff at the different levels through working groups consisting of the representatives of the P.W.D. Agriculture, Revenue, C.D., Forest, Cooperatives and Electrical Departments, are felt to be urgently called for in this State. It is reported, however, that a Committee which recently went into this question, has recommended the retention of the present multipurpose set up of the P.W.D. presumably for reasons of economy.

7.8. On the other hand, there are some States where no special machinery has recently been set up to tackle problems of co-ordination. It may be that the problems are not relatively as acute at the top level in these States as in others. In Andhra, the Revenue Department seems to be in overall charge of funds to be spent on minor irrigation and responsible for reviewing the progress achieved. In Kerala, the P.W.D. is responsible only for the construction and restoration of minor works. In Assam, inter-departmental co-ordination is not reported to be a serious problem, since only two Departments viz., Agriculture, and Embankment and Drainage Division of the P.W.D. handle the minor works. The situation in West Bengal is also similar. The concerned Departments are only Agriculture and Irrigation, tank improvement scheme being handled by a unit of the Agriculture Department. Not that co-ordination problems in these States do not exist; but they are of a different dimension.

7.9. *Co-ordination Machinery at District and Block Levels* :—The question of co-ordinating the planning and more particularly the execution of minor irrigation schemes handled by different departments becomes more relevant at the district and block levels. In most of the States (Mysore, Gujarat, Maharashtra, Madras, Andhra, Kerala, Bihar, U.P., Madhya Pradesh), there are regularly constituted co-ordination bodies, variously known as District Co-ordination Committees, District Development Councils, District Development Boards, District Planning Committees etc. In some States, these co-ordination bodies are just departmental committees presided over by the Collector, and on which the heads at the district level of the Development Departments are represented; while in others non-officials are

also represented on these bodies. In Maharashtra, there is a District Development Board with a sub-committee on irrigation; non-officials are also represented on the Board. The Board prepares a list of minor works to be executed in the district according to a priority depending upon the needs of the area, cost of the scheme, etc. Further, for those districts where there are more than 10 lift irrigation societies, District Co-ordination Committees consisting of the District Agricultural Officer, Executive Engineers, Asstt. Registrar of Cooperative and the Superintending Agricultural Officer have been formed with the Collector as Chairman. Such Committees go into the difficulties of these societies and suggest ways and means of solving them. In Madras, besides a monthly review of the progress of minor irrigation done by the District Collector, an Irrigation Conference of officials as well as non-officials is held every six months to review the progress of repair and maintenance of minor irrigation works. In Punjab, there is, however, no agency at the district or block levels similar to the Minor Irrigation Board at the State level. In Kerala, the District Development Council, presided over by the Collector, is in charge of reviewing the position of all minor irrigation sources in the district. The council includes officials of the Revenue Department and the Irrigation Department, besides nominated non-official members. At the block level, co-ordination in most States is provided by the Block Development Committee or the Panchayat Samiti.

7.10. *Evidences of lack of Co-ordination at the Field Level.*—Available data on the adequacy and effectiveness or otherwise of block level co-ordinating bodies are not sufficient to enable one to make definite generalisations or conclusions. The material presented in the last few paragraphs tends to show that steps have been taken in many States to establish some machinery for effecting co-ordination in the implementation of the minor irrigation programme, particularly at the level of State headquarters. The need for such co-ordination has been felt rather acutely, in the past, between the operations of the Irrigation and the Agricultural Departments. The Agricultural Administration (Nalagarh) Committee had this in mind when they noted "gross lack of co-ordination between the Irrigation and the Agriculture Departments both in planning and execution". With the advent of the Development Department and the blocks, a third agency came into the picture, one of the purposes of which was of course to achieve this much needed co-ordination. It was, at least, expected that in the block areas, the funds of the different departments meant for minor irrigation would be pooled together and a co-ordinated execution of the works achieved. Some progress seems to have been made in this direction in a few States. Thus, in Rajasthan and recently in Andhra also, the provision for minor irrigation in the departmental budgets are pooled together and the funds transferred to the Panchayat Samitis. But the picture we have obtained from the sample blocks shows that the problems have yet to be fully solved.

7.11. The multiplicity of agencies pulling in diverse directions still persists; and the problems seem to become acute at the lower level nearer to the field. Where the minor irrigation schemes should originate and at what stage technical clearance should be taken, is important for co-ordinated working. The GMF schemes are reviewed first at the technical level and then sanctioned. In the C.D. blocks, however, there is a lump sum provision for minor irrigation and land reclamation; and it is after it is after the block



decides on its programme of works that their technical feasibility is judged. All these cause complications. A few instances of either inadequacy or lack of co-ordination at the block level are given in the next few paragraphs.

7.12. In spite of attempts made by the block level co-ordinating bodies, there are cases where information on the location of work being carried out by one agency has not been known to the other, with the result that the two agencies were operating in the same area with possibility of overlapping. In Nowgong district of Assam, the minor irrigation projects executed by the Agriculture Department are not recorded by the Block agency, as no intimation is given to them. The projects remain without supervision; and their maintenance becomes a problem. In fact, this limits the ability of the Block administration to assess the nature and extent of utilization of the works completed and to play an effective role in the extension of improved agricultural practices, suitable varieties of improved seed etc.

7.13. Where two or more agencies have to operate jointly for the successful implementation of a scheme, sometimes due to differences of opinion on techno-economic matters, the work is not carried out with the desired zeal and efficiency. It is reported from a sample block in Ghazipur district, U.P. that as the Irrigation Department prefers to provide irrigation first to sugarcane, it has not been possible for the Block agency to extend programmes for the sowing of crops like moong type I, maize, and berseem in the early period of the Kharif season.

7.14. In Kerala, the block funds allotted for minor irrigation are spent by the Irrigation Department which is responsible for all irrigation works in the State. At the block level, the works programmes are recommended by the panchayats (where they exist) and approved by the Block Advisory Committee. The Block Development Officer, thereafter, sends them to the Irrigation Department indicating an order of priority among the works. The Irrigation Department takes up the works which are within the level of permissible cost, with the approval of the District Development Council. Thus, the block and the people's institutions are involved at the planning stage, while technical scrutiny and execution are left to the Irrigation Department. In this set up, the Block authorities may not have the incentive to help in the execution of the works either by getting contractors or mobilizing other agencies. In some other areas, it has been observed that a sense of departmental prestige and rivalry sometimes stands in the way of better co-ordination, so much so that the block staff are not in a position to play their role effectively. Cases of this nature have been reported from some of the areas where transference of the management of minor works from the Revenue Department to the block has recently taken place.

7.15. *Functional aspects of Co-ordination.*—The units which are involved in the minor irrigation programme at the block level and whose co-ordinated working is to be achieved are : (i) the Block Development Officer and the block Overseer, (ii) the District Engineer and his assistant, (iii) the Revenue functionary, the Tehsildar, and (iv) the Agricultural Officer. This set of functionaries has its co-ordinator at the district level in the Collector who is, in some cases, assisted by his sector for minor irrigation. The problems which manifest lack of co-ordination in the day-to-day working originate in the conflicting interests of different sectors. The main functional interests involved are : (a) authority to get work done on contract

for the execution of works and arrangements for their supervision, (c) the power to give technical clearance to the work schemes, and finally (d) the power to grant loans and subsidies to individuals for the construction and maintenance of minor irrigation works.

7.16. Wherever the power to make disbursements is not delegated to the agency which is responsible for on-the-spot execution of the works, delay and friction seem to occur. In our sample block in the Dhar district of Madhya Pradesh, the Collector's Sector finalizes minor irrigation schemes on its own discretion and gives contracts to the contractors without consulting the block Overseer. Even though the block had an overseer for minor irrigation works, the supervision and disbursement of payments were carried out by the junior engineers. As a result, none of the four works expected to be taken up were completed. Later, one of these was taken up and completed by the block staff.

7.17. In certain areas, funds for local works including minor works are made available not only by the Agricultural and Irrigation Departments but also by the Tribal Welfare and other agencies. In such areas there is quite often a multiplicity of local works being undertaken at the block level, over which the block staff have to extend the necessary supervision. In some areas, it has been noticed that all these works are not phased out properly or assigned an order of definite priority in execution with the result that the local or block staff are unable to distribute their time efficiently among the different projects.

7.18. The smooth and efficient working of the minor irrigation programme depends to a large extent on cooperation between the agency sponsoring the work and that giving technical clearance. If the two agencies are different, as is very often the case, and if two do not pull together, the result is not only unco-ordinated utilization of the funds, but at times under-utilization or non-utilization of the funds. This has been found to be the case in a few of the sample blocks.

7.19. The problems that arise generally about loans are : (i) delay in sanction sometimes beyond the period when they are needed, (ii) departmental rivalries over power, authority and even patronage, and (iii) non-availability of list of loanees and disbursements to the block staff. The trouble on these scores come up because in most States, all loan funds available for minor irrigation are not pooled together and utilized in a co-ordinated way through one agency or committee. A multiplicity of agencies exists and the pattern of assistance is not the same for different agencies. In Gujarat, there are several agencies operating schemes for the construction of wells like the land mortgage bank, Revenue Department, the Block administration, etc. Satisfactory co-ordination in planning and execution of the work at the block and district level has yet to be achieved. The schemes of cooperative lift irrigation both in Maharashtra and Gujarat could not reportedly make much headway to the lack of co-ordination between the Agriculture, P.W.D. and the Electricity Board. Similarly, in Mysore, different agencies handled different minor irrigation schemes without much of co-ordination with the result that a single party cannot be prevented from getting loans from more than one source. The ideal arrangement will of course be to have only one agency for verification of the status and economic condition of the prospective loanees, and for disburse-

possible to ensure effective and satisfactory working if the two functions are placed each under the charge of one agency only. What is needed, as our field reports seem to indicate, is more of promptness on the part of the revenue staff for disposing of the status verification cases and to entrust only one agency, say the Block, with the disbursement of all loans in States where this has not been done.

7.20. Departmentalism has been mentioned as a problem in respect of loans. But it has been found also to stand in the way of agreed working, say, on the future maintenance of the works executed by the block. It has been observed in Madhya Pradesh for example, that minor irrigation works are executed by the block staff under the technical supervision of the Assistant Engineer. After execution, however, these are not automatically taken up on the registers of the P.W.D. for maintenance. This results in maintenance work not being looked after at least for some time.

#### PANCHAYATS AND THE MINOR IRRIGATION PROGRAMME

7.21. Both the Mysore (1959) and the Srinagar (1960) Conference of Development Commissioners recommended that "construction of minor irrigation works should be entrusted to the extent possible to local agencies like panchayats and cooperatives. Where the works are on a grant-in-aid basis, these institutions will normally be chosen to receive grant-in-aid and to execute the works. Even where works are given on contracts, it is desirable that these institutions should be utilized". It was also recommended that "the maintenance of minor irrigation works should be entrusted to local bodies and panchayats to the extent possible and adequate technical staff required for this purpose should be organized at the block level". The idea of associating panchayats with the maintenance, if not construction, of minor irrigation works is not a new one, and may be traced to the common practice followed in different parts of the country, though not always strictly defined. Whereas the works owned individually were maintained by the owners themselves, the community owned works or somewhat larger works have usually been looked after by the beneficiaries collectively, sometimes aided or subsidised by the State or by zamindars. Bold steps to hand over certain specified minor works—usually tanks—to the statutory panchayats for maintenance have already been taken in a few States.

7.22. The present and/or envisaged role of different statutory and other community organisations like panchayats, Village Committees, Field Management Committees, etc. in the minor irrigation sphere in different States has been summarized in Table 7.1.

TABLE 7.1

*Role of Different Community Organisations in the Minor Irrigation Sphere in Different States*

State	Organisation	Role envisaged/actual
(1)	(2)	(3)
1. Andhra	Panchayat Samiti	Panchayat Samities will take over all minor irrigation works from April, 1961. Minor irrigation programme now carried over by Revenue Department in block areas will be transferred for maintenance along with the present technical staff.

TABLE 7.1—Contd.

(1)	(2)	(3)
2. Assam	Anchal Panchayat Field Management Committee	Associated with planning of minor irrigation projects. Setting up of bodies to execute and maintain the project, but so far little work has been done by them.
3. Bihar	Panchayat	Associated with the construction of village channels, distributaries and flood protection embankments, and the repairs undertaken by Revenue Department.
4. Gujarat	Panchayat	The Government has decided to handover all tanks (irrigating 250 acres or less; within the limits of village panchayats) under the charge of the Revenue Department or Block authorities at present, to the panchayats that ask for such transfer, subject to certain terms and conditions. The question of the empowering the panchayats to enforce the statutory obligation of beneficiaries under the Bombay Irrigation Act is under consideration.
5. Kerala	Panchayat	Works benefiting less than 200 acres are proposed to be handed over for maintenance.
6. Madras	Panchayat Union	Decided to entrust all minor works to Panchayat Unions; implemented also in some districts.
7. Maharashtra	Local Sector	Panchayat and other local bodies are associated with the minor irrigation programme only in the case of works executed from the block funds. The question of including works like tanks, bandharas etc. irrigating upto 250 acres in the local district sector is under consideration.
8. M.P.	Panchayat	Entrusted with the maintenance of work irrigating less than 100 acres which are constructed or renovated on grant-in-aid basis by the blocks. Government is considering to entrust the maintenance of all tanks irrigating less than 100 acres.
9. Orissa	Panchayat	Works irrigating less than 60 acres are proposed to be handed over to panchayats for maintenance under the Irrigation Rules, 1961 when the Act is enforced. Panchayats hire out pump sets to cultivators and maintain them with funds obtained from the hire charges.
10. Punjab	Panchayat Samiti	Renovation and sinking of wells, repairing and digging of private tanks, and maintaining Government minor irrigation sources and supply channels are proposed to be the role of Panchayat Samitis.
11. Rajasthan	Panchayat Samiti	Tanks irrigating less than 50 acres transferred to Panchayat Samitis for maintenance. Water charges collected from the beneficiaries for water supplied from these tanks will go to the Panchayat Samitis.

TABLE 7.1—*Contd.*

(1)	(2)	(3)
12. Mysore	Panchayat	The Taluk Board can take up the construction and maintenance of only those minor works which have an ayacut of less than 10 acres. Taluk Board may, however, carry out any work entrusted to it by the Government for carrying out which the necessary funds are placed at its disposal. Under the new panchayat legislation, village panchayats as such are not associated with the maintenance of works
13 U.P.	Gaon Sabha	All minor irrigation works irrigating upto 50 or 100 acres are proposed to be transferred to the gaon sabhas for maintenance.
14. West Bengal	Panchayat	There are proposals to entrust works to panchayats. There is also a proposal to hand over ex-zamindari tanks to panchayats for maintenance.

7.23. The above review shows that the general tendency in all States has been in the direction of associating panchayats increasingly with the working and maintenance of minor works. The record of the panchayats in this line of work has not, however, been bright. The unsatisfactory working of the tank panchayats in Mysore is mentioned by the COPP in its Report<sup>3</sup> and under the Mysore Village Panchayat Act, 1959, taluk boards can take up minor works with ayacut less than 10 acres but not the village panchayats. Experience elsewhere is also not so encouraging. In our sample blocks in Dhar district, Madhya Pradesh, it is reported that the operation of the *Collector's Sector*<sup>4</sup> for the construction and repair of wells, have made the panchayats only the disbursing agency. The actual work is done through contractors authorized by the *Collector's Sector*, while the panchayats only release the funds given to them. In U.P., in the sample blocks in Ghazipur district, the ex-zamindari tanks and ponds are reported to have been transferred to the gaon samaj for maintenance, but so far no measures have been taken by them for maintenance. In Orissa, though it is the Government policy to have all works executed through panchayats, it is reported that there are very few panchayats which are capable of executing such works. The panchayats are not in a position to take up these works mainly because of paucity of funds. In a sample block in the Dhenkanal district of Orissa, some small tanks yielding an average income of about Rs. 100 from fishery have been transferred to panchayats. These bodies, however, are unable to look after the proper maintenance of these tanks on account of lack of financial resources. It is reported that in Bihar, panchayats are financially weak and do not come forward usually to undertake works like desilting of tanks in spite of a grant to the extent of 50% of such works. In West Bengal, certain works executed in the northern

<sup>3</sup>Page 13 of COPP Report on Minor Irrigation Works in Mysore State.

<sup>4</sup>In 1954, in order to step up the irrigation programme in Madhya Bharat, a special sector called Collector's Sector was formed in addition to the P.W.D. The Collector was authorized to undertake work costing up to Rs. 25,000. These works were to be executed from the agency of the Collector under the guidance and supervision of the

part of the State where handed over to the village committees of beneficiaries. It is reported that the beneficiaries evinced some initial interest in maintenance, which lasted for the first two or three years, after which their enthusiasm waned and the works became inoperative within a few years.

7.24. In Madras, the Madras Panchayats Act, 1958 empowers the Government to transfer to the panchayat or the Panchayat Union the functions relating to (a) the protection and maintenance of irrigation works, (b) the management of turns of irrigation, and (c) the regulation of distribution of water from the irrigation work to the fields. The State Government, however, have decided that these functions should be transferred to the Panchayat Unions and not to the panchayats, though they have no objection to the Panchayat Union entrusting to the local panchayat execution of the maintenance works, the management of turns of irrigation and the regulation of distribution of water, if the ayacutdars of the irrigation source request in writing that such entrustment should be effected, and if the panchayat concerned agrees to abide by the conditions under which the irrigation source has been transferred to the Panchayat Union. District Collectors have been vested with powers to execute the provisions under the Act with a number of stipulations like :—(a) The transfer of works shall be restricted to minor irrigation sources in charge of the Revenue Department only; (b) The Panchayat Union shall not effect any alterations in the sluices of the irrigation work or interfere with the standards and specifications laid down in the Tank Restoration Scheme Memoirs; (c) The Panchayat Union shall be responsible for keeping watch over the bund or irrigation work during the rainy season; (d) The panchayat shall make good any damage to the work resulting from its misfeasance or non-feasance; (e) All works shall be carried out under the control and supervision of the panchayat union engineer (block engineer or supervisor) and shall be subject to the supervision of the Revenue Divisional officer also; (f) The Panchayat Union shall have the power to regulate the manner and order in which the lands under the irrigation work shall be irrigated; (g) The Panchayat Union shall not excavate earth at any time for any purpose within thirty feet or within either toe of the bund of the irrigation work.

7.25. To enable the Panchayat Unions to carry out the functions entrusted to them, the Government shall make available to them a special annual grant known as "local irrigation grant". The amount of this grant shall be fixed by the Collector for each block taking into account the average annual amount spent on repairs for all the minor irrigation works in the block during the past five years and with a minimum and maximum limit of Rs. 1.50 and Rs. 2.50 per acre, respectively. This grant shall be credited to a separate fund which shall be known as the "Panchayat Union (Production) Fund"; and shall be accounted for separately from the General and the Education Funds of the Panchayat Union. Care is expected to be taken to ensure that the grant is utilized exclusively on minor irrigation.

7.26. In Kerala, the Government has not issued any clear order transferring the completed works to panchayats (wherever existing). But it is found that the Executive Engineer hands over such works to panchayats for maintenance. Relaxation of rules is granted in respect of security deposits in the case of panchayats, local committees and *ad hoc* bodies. For the purpose of financial estimates, however, Shramdan is taken into account to an

has not, however, been forthcoming to the desired extent in many cases; and the panchayats and local committees have incurred losses. It is because of such experiences that a doubt is expressed about the ability and technical competence of the panchayats in Kerala to maintain the works up to the desired standards.

7.27. In Andhra, there was considerable dissatisfaction with the earlier system of maintenance of minor irrigation tanks. The recent move of the Andhra Government to bring the panchayats and the Panchayat Samitis into the picture has aroused new hope in many quarters. The Andhra Pradesh Panchayat Samiti and Zilla Parishad Act, 1959 has provided for the undertaking of construction, repair and maintenance of minor irrigation works by the Panchayat Samitis. The Government have followed up this Act by passing orders in July, 1960 transferring the control of maintenance and ordinary repairs of tanks from the Revenue Department to the Panchayat Samitis. It may be added here that the Study Team on Minor Irrigation of the COPP recommended that the Revenue Department may maintain tanks with an ayacut of 50 to 200 acres, while those below 50 acres may be maintained by the panchayats. It is too early to say how the situation would develop under the new system of Panchayati Raj. The proper discharge by the new bodies of their responsibilities will, however, depend on the extent to which satisfactory rules are framed for their guidance and special technical cadres are made available to them.

7.28. In Rajasthan also, Panchayati Raj has ushered in a new pattern of administration of minor irrigation. The functions of the village panchayats were earlier divided into two categories—obligatory and optional. Maintenance of minor irrigation works which did not irrigate more than 50 acres fell in the first category while their construction fell in the second. This distinction, however, has now been abrogated by an amendment of the Panchayat Act (Act No. 21 of 1960), under which the Panchayat Samitis are expected "to draw up plans for the area and execute them through panchayats and functional committees". The jurisdiction of the Panchayat Samiti would, therefore, extend to works that serve more than one panchayat or are beyond the capacity of a single village panchayat. The Samitis are provided with funds by the Agriculture Department. Loans for construction and repair of private works are also channelled through them. They are given a 50% subsidy to meet the cost of construction, repair and restoration of tanks. An Assistant Engineer (Minor Irrigation) under the Development Department carries out in the block areas works costing up to Rs. 25,000 on behalf of the Panchayat Samitis. Further, they also undertake other community owned minor works like renovation of wells, construction of new wells, etc. under the technical supervision of the Agriculture Department.

7.29. It is too early to assess how the new system will eventually fare in respect of efficiency and achievement. The progress so far does not seem to have been very satisfactory. The Panchayat Samitis in Rajasthan were allotted Rs. 45 lakhs in 1959-60 and 1960-61 for works on minor irrigation tanks, of which they could spend only about Rs. 89,000 up to September, 1960. The work done was negligible, even though a number of schemes drawn up by the engineering officials were pending with the Samitis for consideration. That the Samitis have not taken up the maintenance of irrigation works falling within their jurisdiction has also been noted by a

Study Team of the Association of Voluntary Agencies, who observed "this gave the Panchayat Samitis an appearance of functioning merely as disbursers of money for schemes operating in village panchayat areas".\*

7.30. The review given above has been somewhat patchy, mainly because the role of the panchayats in developmental activities including minor irrigation is undergoing a change all over the country. Experience in the earlier years has generally been unfavourable, so far as the panchayats are concerned, in most parts of the country. It must, however, be admitted that panchayats had to operate in the past under serious difficulties and handicaps, created partly by the inadequacy of funds and partly by the lack of trained technical personnel. Both of these problems still remain to a considerable extent. In the meantime, the Panchayat Samitis are coming more and more into the picture with the extension of Panchayati Raj. The evidence so far is not conclusive enough to draw any inference as to how the new system would operate and to what extent it will be able to improve the state of affairs.

#### LABOUR COOPERATIVES

7.31. Of the 42 blocks in the sample for this study, four reported Labour Contract Societies being associated with irrigation works. These blocks are located in Kerala and Madras. None of the two works allotted to the society in one of our sample blocks in Kerala could be completed by them. In the other block, Kazhakuttam in Kerala, the five works allotted to the society were completed but not satisfactorily. In all these cases, the works assignment had to be cancelled and given to contractors on open tender for completion. In giving contracts for works on tanks in Madras, preference is given first to the ayacutdars of tanks taken up for repairs, next to Labour Contract Societies and then to Panchayats. Tenders from private parties are invited as a last resort. Labour Contract Societies (L.C.S.) are granted relaxation from rules in regard to security deposit. Information obtained by us shows that as the members of these cooperatives are not technically equipped to take up the irrigation works, the L.C.S. are, in many cases, reduced to the position of an intermediary, giving sub contract to others. It appears from the record of work of the L.C.S. in these four blocks that if these are to be encouraged and promoted, they need to be helped technically as well as financially. Sometime, it is also a question of technical skill of the members of the societies, when it comes to works other than earth-moving. When such operations are largely involved, it is better to be realistic and examine the technical competence of each Society before it is entrusted with such works.

#### LAND ACQUISITION PROBLEMS

7.32. Difficulties and delay in land acquisition is another hurdle in the implementation of the minor irrigation programme. It is well-known that land acquisition is a time consuming process and has stood in the way of timely completion of a number of works. Cases of delay and difficulties in land acquisition hampering the progress of the minor irrigation programme, have been reported from a number of States. In Orissa, there was a programme of bringing an area of about 1.72 lakh acres under irrigation during

\*Report of a Study Team on Democratic Decentralisation in Rajasthan (1961), Association of Voluntary Agencies for Rural Development, page 12.



the First Five Year Plan period but actually only 1.17 lakh acres could be benefited. One of the main reasons for the progress lagging behind the target was delay in disposing of land acquisition cases. In Kerala, there are special Deputy Collectors to deal with land acquisition for major works. For minor works, the Irrigation Department has to depend on the regular revenue officers. Due to delay in disposing of land acquisition cases, land owners are sometimes persuaded not to go for the acquisition proceedings. In case persuasion fails, irrigation works are even given up in difficult situations. The problem is also very serious in Mysore. Even an integrated programme of minor irrigation, afforestation and soil conservation, in which three Departments, namely the P.W.D., the Agriculture and the Forest, were involved reportedly could not make headway because of difficulties in initiating the land acquisition proceedings.

7.33. Difficulties about land acquisition have stood in the way of restoration of the jagirdari tanks in Rajasthan. The beds of these tanks are in many cases owned by the jagirdars, who resort to cultivation of the beds by letting off water. The State could not take up renovation because of legal difficulties in the acquisition of land. Some of the jagirdars have submitted writ petitions in the High Court. This situation is common in Bhilwara district of Udaipur division where some jagirdars have enforced their right under the law. On the other hand, as the period of temporary allotment is only five years, cultivators are not forthcoming to take up the cultivable lands coming within the command of the tanks. Perhaps, a solution can be found by paying compensation to the landlords and making the allotment permanently to cultivators. The State Government have appointed a committee to go into the whole question and to amend the relevant clauses of the two important Acts, namely, Rajasthan Colonisation Act, 1954 and the State Agricultural Land Utilization Act.

7.34. The procedure followed in West Bengal in this respect may be worth mentioning. The Irrigation Department of the West Bengal Government is vested with legal powers to deal with land acquisition cases. It does not have to depend on another Department for this purpose. It is not our intention here to suggest this as the method of solution applicable to all States. Difficulties arise in land acquisition for a number of reasons. In many States, the problems of the departments operating the minor irrigation programme cannot be fully understood or given sufficient importance in land acquisition proceedings, because some other department handles these cases. In certain States, the legal framework under which land is acquired may not be flexible enough to permit quick disposal of cases. Both of these are difficulties which may not be solved very easily. On top of this, the problem is further complicated by the genuine fear of the person, whose land is to be acquired, that the amount of compensation he may get will be lower than the present value of the land. It is beyond the scope of our study to get further into these problems. They obviously need to be considered by committees or bodies more competent in this field.

#### CONTRACTORS AND MINOR IRRIGATION WORKS

7.35. The shortage of contractors with requisite technical skill and financial stability is also a factor hampering expeditious execution of minor irrigation works of certain types. The difficulty of getting good contractors is particularly acute in States like Orissa and Madhya Pradesh, where qualified contractors are not particularly keen to take up works sited in

areas remote and difficult of access. In Orissa, many of the contractors who tender for such works generally lack the experience and capacity to undertake such works. As a result, the works are not, in many cases, completed by them in time nor do they conform to the prescribed standard. The slow progress in the execution of the tube-well schemes in Gujarat is also reported to be due to the same reason. The contractors there complained that the works were scattered in the interior areas. In Kerala, it has been observed that small contractors are not able to complete the works speedily as they take up a number of works in different places and face shortage of finance. Their financial difficulty has been aggravated also by the bank crisis in the State.

7.36. In West Bengal, "small irrigation" schemes involving construction of bunds and diversion weirs are generally initiated by the local cultivators. 45 per cent of the cost is borne by Government and the remaining 55 per cent by the beneficiaries in cash or in the form of labour. After the beneficiaries committees complete their part of the work, the Government invite tender for their part. The local beneficiaries committee, if it submits the tender, is asked to execute the work at the lowest rate received by the Government. This practice is, no doubt, adopted with a view to associate beneficiaries with the execution of works, but has prejudiced local contractors against submitting their tenders for any of the works, as has been reported from the sample blocks in the northern part of the State.

7.37. In the Srikakulam district of Andhra, the system of tenders has been done away with in the case of the beneficiaries. Maintenance of tank is carried out through ayacutdars. The Tehsildar selects one ayacutdar from among the applicants, preferably the cultivator with the largest irrigated holding under the irrigation works with a view to creating in him a personal interest. The selected cultivator has to deposit 2½% of estimated cost as security. The system is reviewed every year. A ceiling on the estimated expenditure of Rs. 5,000 is set for works which could be entrusted to the beneficiaries.

7.38. While competitive tender system is not so much in line with traditional Indian system, there is every need to ensure that the parties selected for execution are local, picked up more or less with common consent, and command confidence of the beneficiaries.

7.39. *Other Factors.*—Execution of the minor irrigation programme has, according to field reports, been facing a few other problems also. Experienced personnel able to adapt their technical knowledge to different types of constructional works have not been available in sufficient numbers. This shortage has been felt in a number of States. In Assam, the post of overseer is going vacant in many blocks. In the majority of the blocks in Orissa, the overseers or sub-overseers are inexperienced and not qualified or experienced enough in either carrying out the preliminary survey work or their execution. Shortage of labour—skilled and unskilled—is another problem in the sparsely settled parts of the country. Still another problem in some States is the disparity between the rates in the P.W.D. schedule and those paid by the C.D. or Revenue Departments. This disparity often works to the disadvantage of the Community Development programme in respect of minor irrigation activity.

7.40. To sum up, the gravity of the problem of co-ordination between the Irrigation and Agriculture Departments was felt even in the past. With:

the advent of the Development Department in the blocks, they became more pressing at the block and district levels. Efforts have been made to tackle some of the problems; but more needs to be done. The recommendation of the Annual Conference of Community Development, 1960 regarding the setting up of a unified agency for handling minor irrigation works in the States need to be followed up more vigorously. The problems nearer the field deserve better attention. In the day-to-day working at the lower level, lack of co-ordination has its origin in the conflicting interests of different agencies in matters like authority to get work done on contract and to disburse funds for the works executed, authority to get work done by the block overseer, the power to give technical clearance to the work schemes, the power to grant loans and subsidies to individuals, etc. In some areas, it may help to delegate the power of making disbursements to the agency which is responsible for on-the-spot execution of works. Safeguards should be put in against the dangers of dual control over the block overseers—administrative control of the B.D.O. and technical control of the Assistant Engineer of the district. We are not, however, saying anything against this system. Regarding distribution of loans, a satisfactory arrangement can be made if the two functions *viz.* verification of the status and economic condition of the applicants for loans and disbursement of the loan amounts are placed each under the charge of one agency only. With better promptness on the part of the revenue staff in disposing of status verification cases and the disbursement of all loans in the block areas by the Block authority, a good deal of complications can be solved.

7.41. Problems arise at the village level also, for the solution of which the recent tendency in all the States is to associate panchayats with the execution and maintenance of minor works. In the past, they have operated under serious handicaps created partly by the inadequacy of funds and partly by the lack of trained technical personnel. Both of these problems still remain to a considerable extent. As regards the other village institutions labour cooperatives have been reported to exist in few of the States. But, for works involving operations other than earth-moving, *i.e.*, operations requiring greater skill, it would be more realistic to examine the technical competence of each society and its members before assigning such works. Difficulties arise in respect of land acquisition partly because problems of departments operating the minor irrigation programme cannot be fully appreciated by the other department that usually handles land acquisition proceedings, and, partly because the legal framework under which land is to be acquired is not flexible enough for all situations.

## CHAPTER VIII

### STATE TUBE-WELLS

#### INTRODUCTION

8.1. Problems of minor irrigation have been analysed in the earlier chapters mainly with reference to tanks and wells. The other sources that have figured in the sample areas have not been analysed separately, because of the small numbers involved. Besides, we also wanted to concentrate on these two main sources of minor irrigation. In designing this study, however, an attempt was made also to include State tube-wells within its scope. Sample blocks were accordingly selected in three districts, two in U.P. (Ghazipur and Saharanpur) and one in Punjab (Patiala), with a view to making a special field study of the problems of State tube-wells. The study had to be confined to the field data collected from six blocks in these three districts. Of the six blocks in the sample from these districts, one (Rajpura—Patiala) had only three tube-wells in the sample villages; and these to had been functioning for two years. Since the number was small and the period of the development of tube-wells short, this block to be left from the detailed analysis of the data, which is presented in this chapter. In the case of Patiala district, Punjab, the tube-wells selected for study were located in the sample villages. On the other hand in Ghazipur district, Uttar Pradesh, data were collected for all tube-wells located in each of the two sample blocks and in Saharanpur district, U.P., for all tube-wells in the district (except for tables 8.6 and 8.7 of this chapter for which data could be obtained only for the two sample blocks). Before we go into the field data, however, it will be in order to give a general account of the importance of the State tube-well programme in the country, particularly during the period of the two Plans.

8.2. Tube-wells, though of recent origin in India, are important in areas like the Indo-Gangetic plain where there are rich sub-soil water resources. Their advantage over canals lies in the fact that they can be constructed right in the centre of the places where irrigation water is needed or is proposed to be supplied. The flow from the pump outlet to the different fields is by gravity over a relatively short distance; and there is no need to construct an extensive system of distributaries. This advantage is maximum in masonry wells which also exploit underground water resources. Tube-wells, however, combine such small scale economies with proper power use.

8.3. Construction of tube-wells had, in the past, remained confined largely to three States, U.P., Bihar and Punjab. In U.P., the primary consideration in tube-well construction has been to supplement the existing irrigation potential by tapping aquifers. While this has also been the determining factor in the Punjab, there have also been schemes for installing State tube-wells of shallow type to help the anti-water-logging programme. In Bihar, the tube-well programme has been taken up as an insurance against the vagaries of the monsoons. In spite of about 49 inches of average rainfall,

crops have failed in Bihar once in every three to four years because of erratic and untimely rains.

#### GROWTH OF THE STATE TUBE-WELL PROGRAMME

8.4. *Pre-Plan Era.*—The State of U.P. has been the pioneer in launching the programme of State tube-wells. As early as 1931, after the completion of the first stage of the Ganga canal and the Hydro-electric Grid schemes, the idea of sinking tube-wells took a concrete shape. With the increase in the output of hydel power to 18,900 K.W. by 1936, the prospects for starting the tube-well programme became brighter. After examining the various factors and conditions in U.P., it was considered that the most economical size for a tube-well would be an outlet of 1.5 cusecs with pucca channels of one mile length. Separate tube-wells each selling water by volume to individual cultivators at the source, were preferred to an arrangement under which a battery of wells would feed minor distributaries constructed by the Government. Accordingly, a scheme, known as "State Tube-well Project for 1656 wells, 1934-35 to 1942-43" was prepared and completed in the early forties. Another project for 600 tube-wells was taken up at the instance of the Government of India under the programme for the Grow More Food Campaign between 1943-44 and 1949-50. Private tube-wells had also made substantial progress during this period. But we are not concerned in this chapter with the tube-wells in the private sector.

8.5. The total number of State tube-wells installed in U.P. by the end of March, 1946 was 1,847, which irrigated 12.5% of the total area irrigated in the State. During the period 1946-47 to 1950-51, another 458 tube-wells were constructed bringing the total number to 2,305 and the irrigated area to 14%. This was the position at the beginning of the First Five Year Plan.

8.6. In the States of Bihar and Punjab, the State tube-well programme had hardly grown beyond the experimental stage during the Pre-Plan period. Investigations to tap under ground water for irrigation purposes were initiated in the Punjab, as early as the first decade of the 20th Century; and in 1916 some experimental wells were also sunk in and around Amritsar. But it was not until 1950 that the Jagardhari Project aiming at the installation of 256 tube-wells was taken up under the Grow More Food programme. Similar was the case with Bihar which got 300 tube-wells under this programme. This account, it may be repeated, deals only with the growth of the State tube-wells. Private tube-wells had a larger growth during this period. But the private ones are usually much smaller works.

8.7. *State Tube-wells in the two Plans.*—The State tube-well programme received a boost in the First Five Year Plan period. Special allocations were made under the Grow More Food Schemes for the construction of such wells. This was also the case in the Second Five Year Plan period. The magnitude of the programme can be assessed from the fact that 4,290 State tube-wells were completed in the First Plan period, as compared to an estimated number of 3,200 in the Second Plan. An idea of the work done in U.P., Punjab, Bihar and Bombay under the tube-well programme during the two Plan periods can be had from the figures given in Table 8.1.

TABLE 8.1

*Progress of the State Tube-wells Programme in the Two Plans*

(No. of tube-wells)

State	First Plan period		Second Plan period	
	Completed with pump- ing sets	Energised	Completed up to Jan. '61	Energised up to Jan. '61.
(1)	(2)	(3)	(4)	(5)
U.P. . . . .	2,864 (Drilled)	1,785	1,079	2,006
Punjab . . . .	1,075	490	107	687
Bihar@ . . . .	943	758	3	188
Bombay . . . .	226	226	217	217
TOTAL . . . .	5,108	3,259	1,406	3,098

@—Programme completed.

Source : Directorate of Economics and Statistics  
Ministry of Food and Agriculture.\*Including spill over works from  
the 1st Plan.

The figures in Table 8.1 reveal some significant changes in the tempo and direction of the programme in the Second Plan period. First, the rate of construction in this period was significantly lower than in the First Plan period in U.P., Punjab and Bihar. Only Bombay (Gujarat area) showed more or less the same rate. Secondly, Bihar had given up new construction altogether and did not extend the scheme any more. Extension of the tube-well programme in the Second Plan period was thus confined mainly to U.P. and Bombay (Gujarat), if the spill over works from the First Plan are not taken into account. Further, during the First Plan period, only 88% of the proposed tube-wells could be constructed in U.P. and only 78% energised. In the Punjab, only 46% of those installed with pump sets could be energised. The overall achievement in the Second Plan, if the spillover works are not taken into account, does not seem to be encouraging in view of the fact that of 2,969 wells allotted during the Second Plan in the country, 32% were drilled, about 24% were provided with pump sets and only 23% were energised. It is the addition of the achievement in respect of spill over works that makes the picture in this period look better.

8.8. Before a tube-well can be commissioned, three stages of installation have to be completed—construction, fitting with pump set and energisation. Data of the three stages could be obtained for a longer period for U.P. and are presented in Table 8.2.

TABLE 8.2

*Progress of Installation of Tube-wells in U.P. 1951-52 to 1960-61*

Year	No. constructed		No. fitted with pump sets		No. energised	
	Up to	In	Up to	In	Up to	In
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1951-52						
1952-53	1,103	N.A.	1,103	N.A.	781	N.A.
1953-54						
1954-55	1,721	618	1,721	618	1,342	561
1955-56	2,864	1,143	2,480	759	2,188	846
1956-57	3,397	533	3,091	611	2,897	709
1957-58	3,647	250	3,387	296	3,278	381
1958-59	3,762	115	3,670	283	3,623	345
1959-60	3,830	68	3,745	75	3,745	122
1960-61	3,948	118	3,833	88	3,791	46

N.A. = Not Available.

It appears from the figures in Table 8.2 that the rate of growth of tube-wells, whether in construction or in the fixing of pump sets or in the installation of power, reached the peak in the last year of the First Plan and has since slowed down. By the end of the Second Plan period, the rate of new construction and installation tapered off to a trickle of what it was in the earlier years of the decade.

8.9. In any case, the figures show the importance of the State tube-wells in providing irrigation not only in U.P. but also in Punjab, Bihar and Bombay (Gujarat). There are a number of problems relating to the location, administration, operation, management, maintenance and utilization of the irrigation facility provided by the tube-wells. The remaining part of this chapter will deal with the problems connected with the location and siting of the tube-wells, the fixation of their culturable command area, the performance of the tube-wells in respect of costs and revenue from rates, and the distribution of utilization of tube-well water.

#### LOCATION AND SITING OF TUBE-WELLS

8.10. Information obtained from the sample blocks tends to show that the siting of the wells has generally been satisfactory and judicious. There are, however, a few instances of unhappy location. In Rajpur block (Punjab), the water in many of the tube-wells is saline or brackish; and in some there is no water at the source. An analysis of water of some 60

wells done by the Agricultural Chemist of the Punjab Government reportedly showed that water in 26 (43%) of these was unsuitable for irrigation. Cultivators do not like to use this water, but have no alternative to applying it on their fields in times of necessity, as there is no other source available. In some tube-wells, the salt content is reported to have reached a critical limit; and it is feared that with continuous use of such water, the cultivated land will become alkaline.

8.11. It has been observed in Saharanpur (U.P.) that a few tube-wells cannot effectively serve their culturable command area, because these are not centrally located and/or the level of their site is low. While siting is normally decided on the basis of the results of a survey of the topography and needs of the area, in actual field various pressures have, in reality, to be reckoned with at times. The Irrigation Department have also to contend with another difficulty. Since the use of diesel power is not usually favoured, location of any tube-well cannot, it is understood, be fixed beyond three miles of the hydel line. This does act as a handicap in the determination of proper sites. Sometimes, there are other factors like the seasonal rise in sub-soil water. It has been observed in one of the sample blocks in U.P. that two State tube-wells remain idle for four months in the year for this reason.

8.12. In Bihar, some tube-wells are located in places with surrounding fields growing tobacco and chillies which require less irrigation. Such location necessitates longer channels for reaching the fields of water intensive crops. One solution is to persuade the owners of neighbouring fields to switch over to wet crops, which does not seem feasible under the existing pattern of preference of cultivators for cash crops.

#### FIXATION OF THE CULTURABLE COMMAND AREA

8.13. In determining the C.C.A. of a tube-well, several factors have to be taken into account like its discharge, topography of the area round its location, rainfall and its distribution, types of soil, crops sown in the area, crop rotation followed by the cultivators, number, size, location and dispersal of paddy blocks, whether the paddy blocks are compact and need tube-well water regularly or only in times of failure of rains. In reality, however, the practice followed in determining the culturable command area of a tube-well appears to be basically the same as in the design of canal irrigation projects. The culturable command area in the case of canals is often much more than the maximum area that can be irrigated in a particular season. Similarly, the culturable command area for a tube-well is not the maximum area that it can irrigate, but a total area, which is at least 50 to 60% greater than what it can actually irrigate when full utilization develops. It has generally been assumed for a long time that the C.C.A. of a tube-well should be one and a half to two times the area which it can irrigate, in order to allow for factors like rotational following of land and the dispersal of wet crops in non-compact blocks. This line of thinking will be apparent from the figures of C.C.A. of the State tube-wells in our sample areas. Figures of the average area irrigated (gross) per year per tube-well in the sample areas in U.P. and Punjab in the years 1955-56 to 1959-60 are given in Table 8.3 along with those of the average C.C.A. per tube-well in these areas.



TABLE 8.3

*Average Area Irrigated (Gross) per Tube-well in the Sample Villages in U.P. and Punjab, 1955-56 to 1959-60*

Year	Gross area irrigated per tube-well (acres)				
	Uttar Pradesh			Punjab*	
	Districts			State	
	Ghazipur*	Saharanpur@	Total	Total‡	
	(1)	(2)	(3)	(4)	(5)
1955-56 .. .. .	141.9	256.8	243.5	306	63.8
1956-57 .. .. .	130.7	284.4	262.7	271	105.8
1957-58 .. .. .	226.2	326.4	309.6	340	232.3
1958-59 .. .. .	198.3	311.7	291.6	286	215.5
1959-60 .. .. .	239.7	373.4	351.7	326	339.5
Average culturable command area per tube-well (in acres) .. ..	989	938	947		863

\*Refers to sample blocks.

@Refers to district as a whole.

‡Supplied by the State Government.

8.14. In U.P., the average C.C.A. per tube-well in the study comes to about 900 acres for the western districts and about 1,000 acres for the eastern part of the State. In the eastern U.P., particularly in the districts of Ghazipur and Azamgarh, only about 35 to 40 per cent of the total culturable command area of a tube-well is expected to be covered when full utilization develops. The tube-wells in the area are of 1.5 cusecs each. One cusec is supposed to irrigate 180 acres per season if only one watering is to be given. As the average watering for Kharif (mainly sugarcane) comes to 2.6 and average water discharge is low, a tube-well in this area is expected to provide irrigation to about 100 acres in Kharif and 250 acres in Rabi, Rabi being irrigated only once. Thus, the total area which a tube-well is expected to irrigate comes to about 350 acres while the culturable command area in these districts is still considered to approximate to 1,000 acres. This disparity is sought to be explained in terms of lower consumption of water required for maturing Rabi crops, and bigger discharges of new tube-wells recently sunk. The position is a little better in the western parts. But, on the whole, the culturable command area does not seem to be in conformity with the capacity of the tube-wells. The disparity is even greater between the area irrigated and the C.C.A., as the figures in Table 8.3 show. While the area irrigated has shown a rise over the last few years, the figure for 1959-60 was only 240 acres per well in Ghazipur against a C.C.A. of 989 acres and of 373 against 938 acres per well in Saharanpur. The performance is obviously better in Saharanpur, and the disparity also less.

8.15. In the Punjab, the culturable command area of State tube-wells as fixed at present is on the high side. The wells cannot even irrigate half of the area in one season. For instance, in one of the selected villages in Doraha, two State tube-wells have C.C.A. of 833 and 867 acres; but even after the lapse of five years the maximum irrigated area has come up to 372 and 392 acres respectively. The average picture in the sample block, as given in Table 8.3 shows an even higher disparity, 340 acres of irrigation in

1959-60 against a C.C.A. of 863 acres approximately. This point seems to have been raised by the Agriculture Department in a meeting of the State Working Group, and the view expressed that the C.C.A. as fixed was unrealistic.

8.16. Fixing the C.C.A. on the higher side, on the one hand, adds to the difficulty of irrigation and increases its cost. If water is attempted to be taken over the entire areas, particularly when only kutchha channels exist beyond a point, as is almost always the case, there is wastage of water through seepage and the cultivators cannot control or supervise long kutchha channels and prevent leakages therein. If, however, the channels are to be made pucca over the whole area, the cost becomes prohibitive and the tube-well cannot, in any case, suffice for the whole area. On the other hand, the high C.C.A. affects the interests of the cultivators in the command adversely. The Government policy is not to give any loan facility for irrigation to any cultivator within the command area of a State tube-well or even allow other facilities like electric power for private tube-wells. The cultivators are thus deprived of the advantage of the taccavi loan facilities of the Agriculture Department. There is justification for reducing the C.C.A. and determining it in such a way that the intensity of irrigation to be achieved in the tube-well command is much higher, at least 80%, if not more. Fortunately, this line of thinking seems to be gaining acceptance by the State Government.

#### DEMAND FOR WATER AND LOCATION

8.17. Before locating a tube-well in an area, an assessment is supposed to be made of the local irrigation facility, keeping in view the climatic conditions in the area and the cropping pattern. In Saharanpur district (U.P.) the annual rainfall is reported to be increasing, the sub-soil water level is also rising so much so that the extent of dependence on irrigation seems to be decreasing. In some parts e.g., near Roorkee, where there is a network of canals in the vicinity of the tube-well areas, the land obtains plenty of moisture through canal seepage with the result that the requirement of irrigation is much less. Location of tube-wells in such areas have raised serious problems of utilization and consequently, of revenue and expenditure. In Bihar, wherever tube-wells have been located in areas growing predominantly either Kharif or Rabi crops, but not both Rabi and Kharif including hot weather crops, they are reported to be relatively more under-utilized.

8.18. The assessment and creation of demand for tube-well water raise some of the most crucial and difficult issues. A State tube-well is a development project and is intended as such to develop and improve an area. The cropping pattern and the demand for irrigation in an area in the pre-tube-well phase do not necessarily provide an adequate basis in data for the projection of the future course of development. These data by themselves will hardly justify such a venture in many parts of the country, except probably in arid tracts where value-intensive crops cannot be economically raised without artificial irrigation, and where the cultivators are physically and mentally prepared for the change over. In other areas, where the crops to be irrigated are already being grown on a fairly large scale, dependence on tube-well water is likely to be supplementary or marginal. The switchover to new crops may be much less extensive; and the dependence on tube-well will vary according to the nature and conditions of rainfall in a year. A gamble of some order is bound to be there in the tube-well projects in such areas. The prospect of success in such cases will depend on a number of factors like

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the scope for intensification of cropping through the cultivation of a second or third crop where only one was grown before, the extent to which the cultivators switchover to more water-intensive or wet crops, market prices of the different crops, and the desire of the cultivators to raise their levels of yield through better and greater use of water inspite of the payment to be made for it. There does not seem to be any easy solution to such problems particularly in areas where the intensity of cropping is fairly high even without tube-well irrigation.

8.19. There is another aspect of this problem that is very baffling. The tube-well projects are all under the Grow More Food programme. It is presumed that their water will be used mainly for raising the level of foodgrains production. In actual practice, however, they have been used in many parts of U.P. to irrigate sugarcane which is the most important and preferred cash crop in the areas of their location. There is no way to force the cultivator in these matters. It is better, however, to be aware of the nature of the manifold problems in every area before a tube-well project is undertaken. Thus, an initial survey of the cropping pattern in the area and the needs, abilities and preferences of the cultivators in respect of different aspects of crop cultivation may give a more realistic picture of the difficulties involved and the possibilities for the future. In the light of such assessment, efforts may be made by the extension agencies to create and later to augment the demand for tube-well irrigation in the area. This may mean positive attempts to orient the attitudes of the cultivators, help them in farm and crop planning and in obtaining loan and other facilities. In short, the success of State tube-well programme depends on the intensity of agricultural extension efforts put in by the Agriculture Department and the Blocks. The Agriculture Department has, therefore, to play a direct role in the development of the tube-well command.

#### PROBLEMS OF ELECTRIC POWER SUPPLY

8.20. Unless there is a guarantee of assured supply of power, it may not be economically profitable to add to the number of the existing tube-wells. In Bihar, for example, power shortage is acutely felt during the peak demand period of May-June (Hathwa block). Some tube-wells cannot work to full capacity and their discharge during the night becomes unsatisfactory when much of the available load is diverted for domestic consumption. In the Punjab (Rajpura block), the tube-wells have to be stopped many times because of electric interruptions, short-supply of electric power and variation in voltage. These problems are, however, engaging the attention of the State Government.

8.21. Power shortage has already become a chronic problem in most parts of India, and may not find an easy solution in the near future. It should be noted here that in States like U.P. and Punjab the expectation at the time when the State tube-well scheme was extended on a large-scale, was that cheap hydel power would be available for energising these. In U.P., however, a number of tube-wells are run on thermal electric power, and some even on diesel power. The cost of such power is much higher than that of hydel power. For example, in U.P. the rate of hydel power charges to the tube-wells is about  $3\frac{1}{2}$  pies per unit as compared to about  $2\frac{1}{2}$  annas per unit for thermal power. These are, however, unforeseen and probably unforeseeable problems. It should also be remembered that the distribution cost of electric power becomes relatively high in rural areas

because of the long transmission lines that have to be drawn. It is this relatively high cost of electricity that has been adversely affecting the economics of tube-wells.

8.22. The State tube-wells are not yet paying their way in any of the three States under consideration. The revenue derived from them is lower than the expenses as that the State Governments are incurring every year a loss on account of them. The capital cost of a tube-well depends on the depth of boring and the size of the well which are determined among other things by the hydrological conditions of the sub-soil strata. The capital cost includes expenditure incurred on boring, pump set, electrical and other installations, and structures including quarters for the operator. The recurring costs include on the one side, overhead charges on establishment, depreciation and interest on capital, and, on the other, operating expenses on power, repairs, etc. The operating expenses and the revenue derived from water rates depend on the working hours and the rate charged per unit. An attempt is made in Table 8.4 to show the major items of cost and revenue determining the economics of a typical State-tube-well separately for the three States of Bihar, Punjab and U.P.

TABLE 8.4

*Cost and Revenue of a Typical State Tube-well in Bihar, Punjab and U.P.*

Sl. No.	Item	Amount per tube-well (Rs.)		
		Bihar	Punjab	U.P.
(1)	(2)	(3)	(4)	(5)
1.	Average capital cost	45,947	65,000	40,000
2.	Annual interest charges			
3.	Depreciation charges	2,757	961@	1,200@
4.	Annual establishment charges	800		
5.	Annual pay of operators and mates	850	1,845	1,200
6.	Annual repairs and maintenance	350	510	500
7.	Fixed electricity charges	N.R.	N.R.	1,300
8.	Annual fixed charges	4,557	3,316	4,200
9.	Cost of energy per unit (10 units of consumption per hour assumed)	3 as.	6.77 nP.	3½ pies
10.	Total cost (Rs.)			
	(i)	N.A.	5,686	4,618
	(ii)	N.A.	6,024	4,655
	(iii)	N.A.	6,363	4,745
11.	Total income* (Rs.)			
	(i)	N.A.	5,469	4,600
	(ii)	N.A.	6,250	5,000
	(iii)	N.A.	7,031	6,000
12.	Gain (+) or loss (—)			
	(i)	N.A.	(—)217	(—)18
	(ii)	N.A.	(+)226	(+)345
	(iii)	N.A.	(+)668	(+)1,255
13.	Percentage return on capital cost (+) or (—)			
	(i)	N.A.	(—)0.33	(—)0.04
	(ii)	N.A.	(+)0.35	(+)0.86
	(iii)	N.A.	(+)1.03	(+)3.14

N.A. = Not Available. N.R. = Not Relevant.

@Excludes interest charges.

\* For Punjab at the rate of -/2/6 per unit and for U.P. at the rate of 16000 gallons per rupee.

The rows (i), (ii) and (iii) against Sl. Nos. 10, 11, 12 and 13 relate to 3500, 4000, 4500 hours in the Punjab and 2300, 2500 and 3000 hours in U.P. respectively.

Note : U.P. figures are supplied by the Govt. of U.P. while those of Punjab are taken from the report of the COPP Team except item 13 which is calculated on the Capital cost. Figures of Bihar for items 1 to 9 were obtained from the Bihar Govt.

8.23. A few points should be noted about the figures given in Table 8.4. In the first place, the cost of energy for running the tube-wells varies considerably among the three States. It is the lowest in U.P. where the rate charged to the tube-wells is shown in terms of the cost of hydel power at 3½ pies per unit, against 6.77 ruP. in Punjab. In Bihar it is as high as As. 3 per unit, which is presumably because it is diesel power. Secondly, it may be noted that the annual interest charges on the capital are not included in the figures shown, at least for U.P. and Punjab. If these charges are taken into account, the recurring costs will go up and the level of economic operation will also rise correspondingly. Thirdly, the depreciation charges have been calculated on the basis of an average life-time of 17 years per tube-well. In U.P. a tube-well becomes due for reconstruction as soon as its discharge falls to half of its original capacity or below 15,000 gallons per hour. On an average, this happens after a period ranging from 17 to 20 years.

8.24. An attempt has been made to show in Table 8.4 the level of operation at which a tube-well just pays for its cost (excluding interest charges). It appears that in Punjab, a tube-well has to work between 3,500 and 4,000 hours or roughly about 3,750 hours per year if the revenue derived from it has to balance the annual costs. In U.P., according to the calculations of the Irrigation Department of the State Government, a tube-well can break even (that is just pay for its cost) if it runs for 2,300 hours per year and can fetch a return of 5.4% on the capital cost if the hours worked per year go up to 3,500. It may be noted that with effect from 1961, the U.P. Government have withdrawn the rebate of As. 3 in the rupee that had been in force for a number of years on irrigation charges payable by cultivators. The withdrawal of this rebate has necessarily improved the chances of economic operation of tube-wells by bringing down the economic level of running hours to a minimum of 2,300 per year. Formerly, it was much higher. It may, in general, be said that the economics of a tube-well, given its level of capital cost and overhead charges, depends on the cost of power on the one side and the number of hours it is used in a year, on the other.

#### HOURS WORKED PER YEAR BY TUBE-WELL

8.25. The norms regarding hours of work enable us to assess the position observed in the sample areas. Figures showing hours worked per tube-well per year have been given in Table 8.5 separately for areas where this investigation has been conducted.

TABLE 8.5  
*Hours Worked per Tube-well, 1955-56 to 1959-60*

Year	Hours worked per tube-well per year				Punjab
	U.P.				
	Ghazipur district		Saharanpur district*	Overall U.P.	
	Mardah Block	Deokali Block			
(1)	(2)	(3)	(4)	(5)	(6)
1955-56 .. ..	337	2,119	1,226	1,192	173
1956-57 .. ..	561	1,185	1,310	1,245	473
1957-58 .. ..	1,495	1,363	1,726	1,677	575
1958-59 .. ..	1,248	1,788	1,843	1,794	1,478
1959-60 .. ..	1,779	1,593	2,095	2,027	2,225

\*The data relate to all tube-wells in the district.

The figures show that in the Punjab sample the hours worked per year per tube-well were very low until 1957-58. In the next two years, however, it jumped phenomenally and reached the level of 2,225 hours in 1959-60. One of the reasons for the sudden jump in 1958-59 was the reduction in the water rates by the State Government. Even then, however, the level achieved in 1959-60 was certainly not more than 60% of the norm of 3,750 hours needed for its economic operation. The experience in U.P. is only slightly better. In Deokali block, there does not seem to have been any rise between 1955-56 and 1959-60 in the hours of operation. The tube-wells in the Saharanpur district, however, show a higher level of performance than those in Mardah. Its figure for 1959-60 is higher by about 32% than that of Deokali block. It also shows a steady rise over the years. Even then in 1959-60, their average was 2,095 hours per year, which is lower than the norm of 2,300 mentioned in the last paragraph. While we have no figures to show the performances of the tube-wells in Bihar, the picture there is known to be poorer in most respects than in these two States. The position in Bihar may, perhaps be comparable to that in the eastern districts of U.P. (e.g. Ghazipur).

8.26. It appears from this brief review of the economics of the State tube-wells that there is a wide disparity between the levels of economic performance of tube-wells not only among neighbouring States like U.P. and Punjab but also between different regions in the same State. The disparity in the performance of tube-wells between the eastern and the western districts of U.P. is striking. This can, of course, be explained in terms of variations in rainfall. In any case, one can say that unless the hours worked per year are raised substantially in all the areas in these States, and more so in the eastern districts of U.P. (and also in Bihar), the tube-wells will continue to be a source of loss to the State exchequer.

#### VOLUME OF WATER PER ACRE

8.27. While the operational efficiency in the utilization of tube-well equipment can be judged in terms of hours worked per well per year, this indicator does not relate to the area benefited, and to that extent does not show the efficiency of the tube-well from the angle of the ultimate beneficiary. From his point of view, tube-well operation should be judged not in terms of the above indicator, but of the volume of water available per acre of irrigated land. Data on the volume of water (gallons) made available per acre of irrigated land in the years, 1955-56 to 1959-60 in the sample areas in Ghazipur, U.P., are given below :

#### *Gallons of Water Distributed per Irrigated Acre*

Year	Deokali Block	Mardah Block
1955-56 .. ..	1,26,291	1,26,352
1956-57 .. ..	1,30,623	1,33,332
1957-58 .. ..	1,75,590	1,31,560
1958-59 .. ..	1,86,669	1,87,713
1959-60 .. ..	1,65,012	1,71,170

The figures for both the areas show a steady rise from 1955-56 to 1958-59, but a decline in the year 1959-60.

## UTILIZATION OF FACILITIES

8.28. *Time Pattern of Development and Actual Performance.*—A tube-well after it is energised takes five years or so to develop fully its irrigation potential. The time pattern of irrigation development for a tube-well has been assumed differently in Punjab and U.P., and may even vary within a State. Broadly speaking, the patterns assumed for the Punjab and U.P. are as follows:

Year of operation of tube-well	Percentage to irrigation potential	
	Punjab	U.P.
1st year	15	25
2nd year	38	40
3rd year	50	50
4th year	75	65
5th year	100	80
6th year	—	90
7th year	—	100

Because of the relatively lower rainfall and higher and a fairly uniform level of irrigation-mindedness in the State, Punjab allows only five years for the full development of the potential of a tube-well, as compared to seven years in U.P. But, there are significant regional variations. For example, in the areas of Ghaziabad, Hapur and Bulandshahr in U.P., full development is assumed to be reached within two to four years. In the areas of Roorkee, Farukhabad, Saharanpur, Moradabad, Bareilly, Kheri, Gorakhpur, Jaunpur, Varanasi, Ballia and Deoria, however, the period is assumed to vary from four to six years.

8.29. The actual development on the field does not necessarily follow this time pattern. Table 8.6 presents year-wise data on the extent of irrigation in relation to the culturable command area (C.C.A.) of the tube-wells in the sample in U.P. and Punjab.

TABLE 8.6  
*Area Irrigated as Percentage to Culturable Command Area*

Year	Ghaziipur	Saharanpur	U.P. Total	Punjab
(1)	(2)	(3)	(4)	(5)
1955-56	13.8	27.1	25.5	7.4
1956-57	13.1	30.2	27.7	12.3
1957-58	22.2	35.4	33.0	26.9
1958-59	20.0	33.2	30.8	25.0
1959-60	24.2	39.8	37.2	39.3

For each of the years, 1955-56 to 1959-60, the area irrigated as percentage of the command area has been higher in Saharanpur than that in Ghaziipur. The proportion has increased over this period except for a small dip in all the areas in 1958-59 presumably because of the rainfall factor. In Ghaziipur, there was a slight decline even in the year 1956-57. This can be partly explained by the fact that while the construction of 17 tube-wells in Saharanpur was more or less uniformly spread over the year, in Ghaziipur, almost one-third of the tube-wells under study were installed in 1955-56.

TABLE 8.7  
Irrigated Area as Percentage to Culturable Command Area of Tube-wells by Their Period of Operation

Year of inception	Ghazipur Sample										Saharanpur Sample								
	No. of C.C. wells A.		% age of area irrigated in							No. of C.C. wells A.		% age of area irrigated in							
			1st year	2nd year	3rd year	4th year	5th year	6th year	7th year			1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	
1953-54	..	2	1861	N.A.	13.6	16.2	35.2	22.8	39.7	—	—	2690	26.2	24.1	34.1	39.3	29.2	39.7	—
1954-55	..	4	4062	N.A.	31.8	22.4	35.8	32.0	28.8	—	3	2690	—	—	—	—	—	—	—
1955-56	..	9	9469	6.2	10.6	25.1	15.1	22.8	—	—	—	—	—	—	—	—	—	—	—
1956-57	..	4	3515	7.6	28.4	24.8	31.2	—	—	4	3407	1.5	39.0	38.0	63.5	—	—	—	—
1957-58	..	6	6570	2.6	27.6	25.2	—	—	—	3	3169	23.7	30.2	38.1	—	—	—	—	—
1958-59	..	5	4195	2.7	8.9	—	—	—	—	3	2893	0.8	35.3	—	—	—	—	—	—
1959-60	..	—	—	—	—	—	—	—	—	4	3501	21.7	—	—	—	—	—	—	—

N.A.—Not available.



8.30. The comparison of the rate of development in the command area of tube-wells between the two districts of U.P. is distorted to some extent, because the distribution of the wells by their age differs in the two areas. Table 8.7 presents the data on the development of irrigation separately for tube-wells according to their year of commissioning. On the whole, the performance of the sample tube-wells in Saharanpur district has been better than those in Ghazipur district in each of the six years after their installation. Age-wise also, the performance of different groups of tube-wells in terms of the C.C.A. percentage has been better in Saharanpur than in Ghazipur in different years of their development. The only exceptions have been in the first year for those installed in 1956-57 and 1958-59, and in the second year for those installed in 1954-55. In Ghazipur, a tube-well is expected to irrigate with full development about 35 per cent of the C.C.A. while in Saharanpur it is expected to cover about 60 per cent. We should add here that these figures of the proportion of coverage of the C.C.A. by tube-wells on full development are not probably rigid, which makes any such comparison somewhat loose.

8.31. The area irrigated from a tube-well in a particular year is a function of the volume of water pumped out from that well in that year. The latter depends on the number of hours the well has worked and the rate at which water has been pumped out. Table 8.8 presents relevant data for different years on these three items separately for the tube-wells according to their year of starting between 1953-54 and 1958-59.

TABLE 8.8  
*Efficiency of Discharge of Tube-wells, by Year of Installation*  
(Vol. of water pumped out in '000 Gallons)

Year of working	DEOKALI BLOCK			MARDAH BLOCK		
	Volume of water pumped out per tube-well in the year	No. of hours worked per tube-well in the year	Volume of water pumped out per tube-well per hour	Volume of water pumped out per tube-well in the year	No. of hours worked per tube-well in the year	Volume of water pumped out per tube-well per hour
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	1954-55 (No. of tube-wells=4)			1953-54 (No. of tube-wells=2)		
2nd yr. .. ..	40,900	2,630	16			
3rd yr. .. ..	33,300	1,876	18	20,000	471	42
4th yr. .. ..	60,600	2,851	21	22,200	515	43
5th yr. .. ..	65,500	2,225	29	47,100	1,252	38
6th yr. .. ..	53,300	1,731	31	44,200	1,206	37
7th yr. .. ..				64,400	1,734	37
	1955-56 (No. of tube-wells=1)			1955-56 (No. of tube-wells=8)		
1st yr. .. ..	1,100	76	15	6,600	303	22
2nd yr. .. ..	12,800	642	20	13,300	579	23
3rd yr. .. ..	3,600	605	6	33,600	1,587	21
4th yr. .. ..	7,700	1,542	5	31,300	1,544	20
5th yr. .. ..	3,665	733	5	42,000	1,956	21

(1)	(2)	(3)	(4)	(5)	(6)	(7)
	1956-57 (No. of Tube-wells=3)			1956-57 (No. of Tube-well=1)		
1st yr. .. ..	68,000	444	15	11,900	502	24
2nd yr. .. ..	32,800	1,880	17	37,300	2,250	17
3rd yr. .. ..	42,800	2,178	20	35,700	2,158	17
4th yr. .. ..	39,100	2,058	19	48,300	2,919	17
	1957-58 (No. of Tube-wells=6)					
1st yr. .. ..	6,800	141	29			
2nd yr. .. ..	61,100	2,109	29			
3rd yr. .. ..	49,800	1,661	30			
	1958-59 (No. of tube-wells=3)			1958-59 (No. of tube-wells=		
1st yr. .. ..	6,600	611	11	1,300	106	
2nd yr. .. ..	11,400	1,293	9	24,500	1,043	

8.32. The data given in Table 8.8 are presented graphically in Charts 1 and 2. A glance at the Charts shows that the total volume of water pumped out from a tube-well per year had been rising between 1955-56 and 1958-59, but declined thereafter in Deokali block. Further, in Mardah block, the number of hours worked per year per tube-well has been rising. But in Deokali the figures show a rise for two groups and a fall in another three. The volume of water pumped out per hour per tube-well is more or less constant. This is in conformity with the normal expectation. The only case which becomes conspicuous is in Deokali where one tube-well of 1955-56 pumped out about 20,000 gallons per hour in 1956-57 but only about 5 to 6 thousand gallons from 1957-58 on. The striking point is, however, that in a good number of tube-wells both in Mardah and Deokali, the volume of water pumped out per hour per tube-well has been much lower than the expected figure of 33,000 gallons. For a few the performance is very poor and is either below or close to 15,000 gallons per hour, which is considered the minimum level of pumping efficiency for a tube-well. The data given in Table 8.8 and presented graphically in Charts 1 and 2 are for groups of tube-wells according to their year of start. The picture obtained from these data naturally holds good for the number of tube-wells in each group; and in cases where there are a number of tube-wells in the group, the average may conceal the poor performances of some tube-wells as much as the better performances of some others. In other words, any judgment about the performance of a tube-well should be based on disaggregate micro-data. Accordingly, an attempt has been made in Chart 3 to present graphically the efficiency in the performance of a few individual wells which were grouped in Charts 1 and 2, among those started in 1954-55 (Deokali) and 1955-56 (Mardah). Of these seven wells for which the performance efficiency data are given, five had in 1959-60 recorded an average pumping per hour of a volume of water below 33,000 gallons. In fact, two of them had pumped 17,000 gallons or less per hour. These data show even more clearly that the performances of the tube-wells have been very uneven and, in some cases, rather poor.

#### FIELD CHANNELS

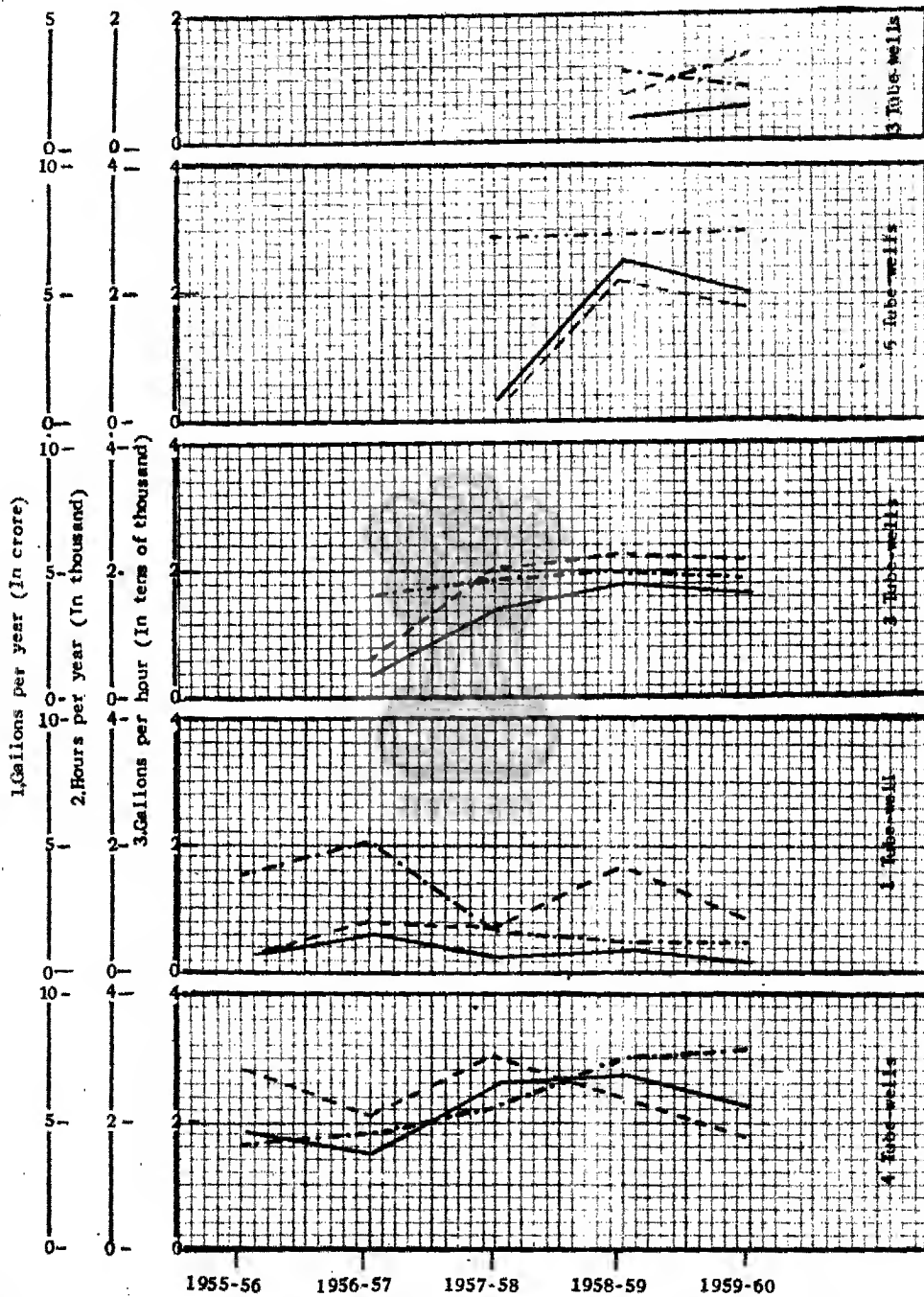
8.33. The problem of field channels is as important in the case of tube-wells as in major irrigation. The Government is responsible for the construction of channels upto a certain length, leaving the remaining part to

the beneficiaries to construct. In Punjab, the Irrigation Department is at present responsible for constructing pucca channels up to a total length of one mile in light soil and half a mile in heavy soil. Beyond this length the beneficiaries are supposed, under the law, to dig channels themselves. In U.P., the rule up to 1947 was to have two miles of field channels (one mile being pucca) constructed by the Irrigation Department. From 1949, however, these lengths have been doubled for most of the tube-wells (two miles of pucca channel in the Government sector). The new practice was put into effect initially in the western region, and seems to have been subsequently implemented practically on all tube-wells in the State, so we have been informed, in the light of the size and conditions of the command area of each well.

8.34. As regards the construction of kutchha field channels by the beneficiaries to lead water from the Government channel to their fields, the practice in the past was to leave it entirely to the cultivators. It has often led to such channels being excavated in a zig-zag manner resulting in a heavy loss of water in transmission. Besides, there have been cases of delay in the construction of field channels, caused by objections raised or non-cooperation shown by some cultivators through whose fields the channels have to pass. To avoid such contingencies as also to enforce the responsibility more firmly on the beneficiaries, a policy decision has been taken at the all-India level to make the construction of field channels obligatory on the part of the beneficiaries. Action along this line has already been taken in Punjab where the Northern India Canal and Drainage Act was amended in 1958. The procedure laid down under the amended Act provides for penal clauses. "Chak-bandi" (commanded area) of the tube-wells will be fixed and the holdings of each cultivator will be marked on the village map plan called "Shajrah". Water courses will be aligned by Ziladar and a certificate of correct alignment will be issued by the S.D.O. (Tube-wells), before the scheme is forwarded to the Executive Engineer who will declare the scheme of alignment of kutchha water courses in the villages and will give a notice of one month to file objections, if any, against the decided scheme. After one month, he will hear all the objections and decide the cases on the spot. The scheme will then be forwarded to the Superintending Engineer for his final approval. Thereafter, a notice of 22 days will be issued to the cultivators by the Executive Engineer to construct water courses approved according to the scheme. If the beneficiaries do not construct the channels within this assigned period, the Government will get the water courses constructed at the cost of the beneficiaries. In case the beneficiaries still resist construction of the channels in their holdings, the Executive Engineer has powers to get it done with the help of police force. Some tube-well schemes have been prepared on these lines and submitted to the Executive Engineer recently. Scrutiny of some more is being done by the Executive Engineer. At the field level, we noticed, however, a feeling that the procedure has been made rather dilatory.

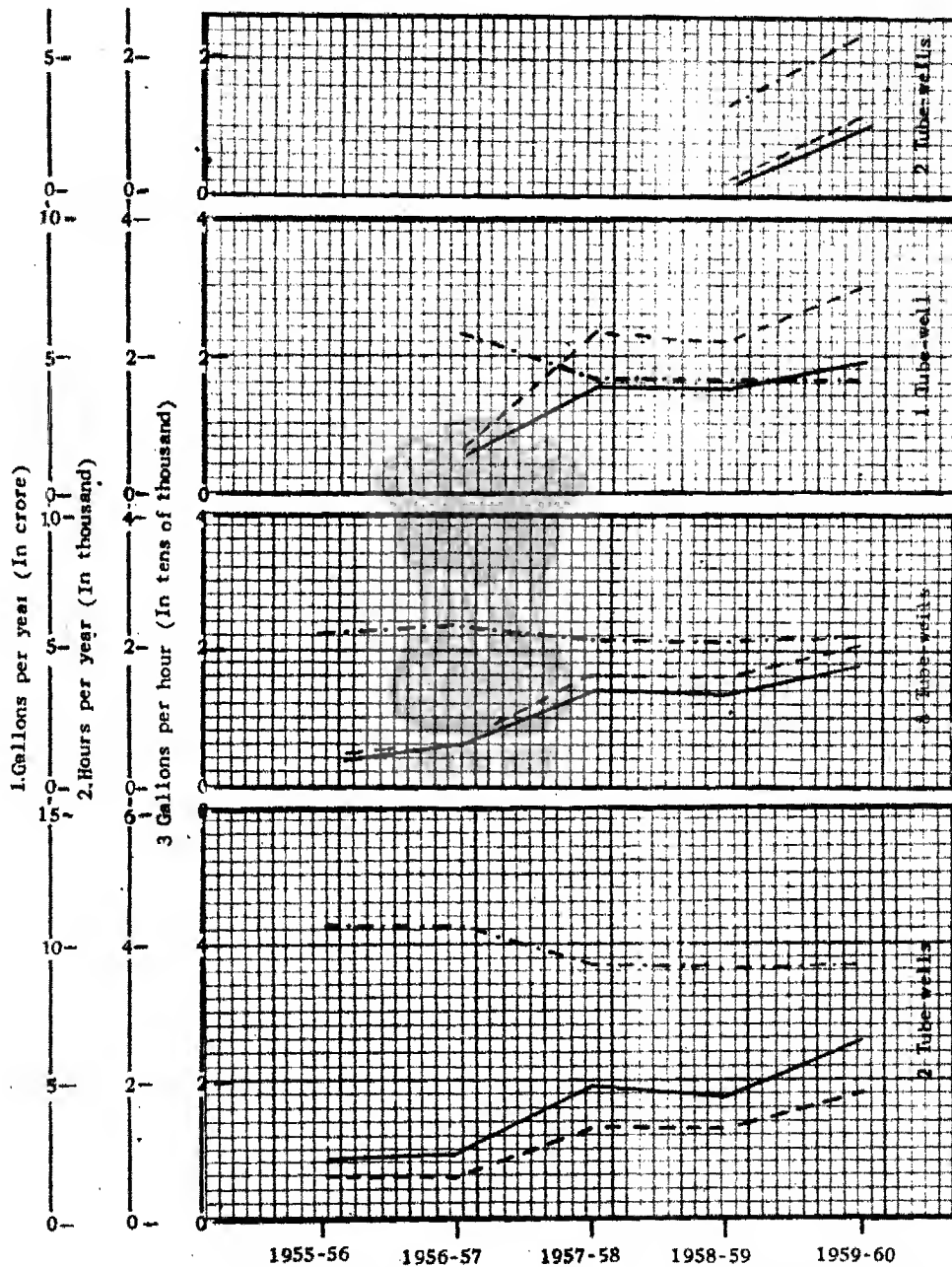
8.35. In U.P., the Irrigation Act has not yet been amended with a view to enforcing the responsibility for the construction of field channels effectively on the beneficiaries through penal clauses as in the amendment passed to Punjab Act. In other words, the State in U.P. has not yet assumed powers to force the cultivators to construct field channels and on their failure to do so, to authorise the Irrigation Department or the local bodies to have these constructed and the cost recovered from the beneficiaries. The major difficulties and complaints associated with field channels are the

Trend of performance of  
(Group-wise)  
DEOKALI BLOCK



1. ————— Average volume of water pumped out per tube-well (In gallon),
2. - - - - - Average number of hours worked per tube-well.
3. - . - . - . Average volume of water pumped out per hour per tube-well (In gallon),

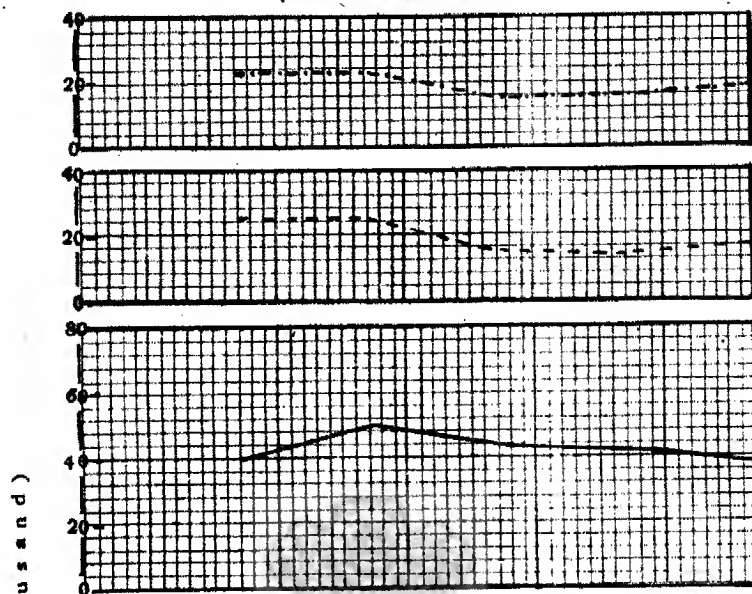
Chart No. 2  
Trend of Performance of Tube-wells  
(Group-wise)  
MARDAH BLOCK



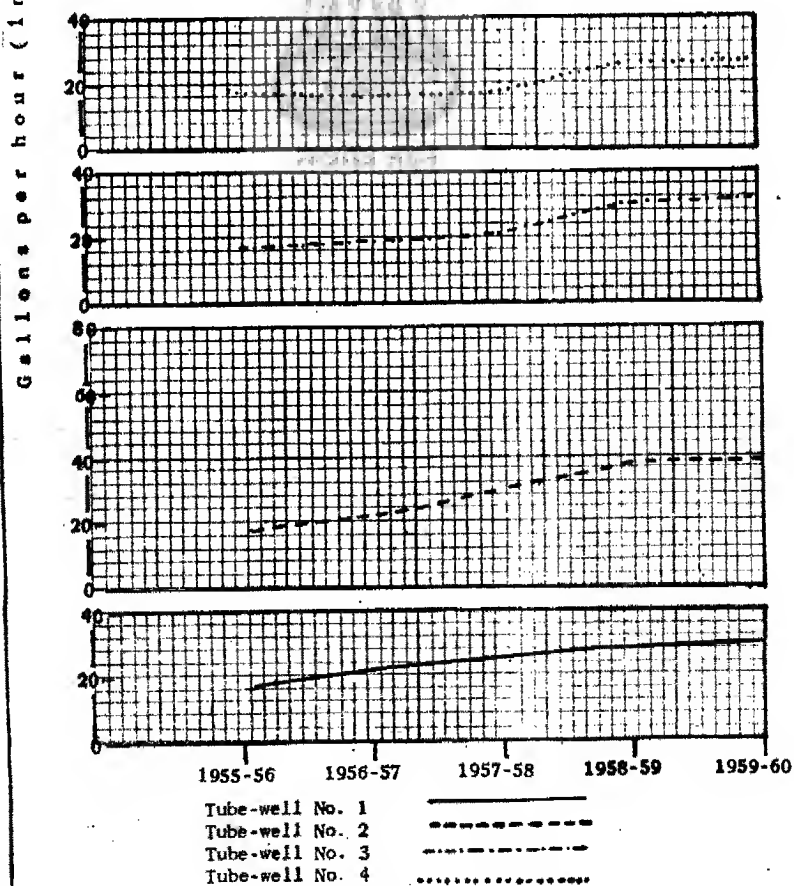
1. ————— Average volume of water pumped out per tube-well (In gallon).
2. - - - - - Average number of hours worked per tube-well.
3. - . - . - . Average volume of water pumped out per hour per tube-well (In gallon).

CHART NO. 3  
Volume of Water Pumped Out per Tube-well per Hour

MARDAH BLOCK  
(Year of start 1955-56)



DEOKALI BLOCK  
(Year of start 1954-55)





For the 17 tube-wells taken together, unlined channels were 53 per cent of the total length. This position has to be viewed against the requirement that up to the year 1947 tube-wells were to have two miles of field channels—one mile being pucca. Data could not be collected on the length of field channels for the wells in Mardah block, but even the local officials considered them inadequate.

8.37. *Maintenance of Channels.*—Complaints have also been reported about the poor quality of the lined channels constructed by the Government and the inadequate nature of their maintenance. It is reported that they are sometimes in a state of collapse and that repair takes a long time. It has not been possible for us to verify the frequency of such cases. The villagers' complaints in these matters sometimes carry an element of exaggeration. But it is true, as the Irrigation Department in U.P. has pointed out, that the channels often get damaged by bullocks and carts going across them. In matters like these, it is only the local people who can effectively help the authorities in the preservation of the channels. It is not probably realistic to expect the Irrigation Department to extend the length of the pucca channels much further or even to spend more money on making the pucca channels stronger. The cost of such operations will add further to the burden of the capital cost of the tube-wells, and to that extent, will affect adversely the chances of their economic operation.

8.38. There are a few other complications observed in the field. In some areas, the alignment of the field channels is not shown on the village maps prepared in connection with the consolidation of holdings. This is a matter of detail which can be looked into. Basically, however, the problem of field channels has to be solved through the cooperation of the villagers with the Irrigation officials. Damages to field channels caused by inadvertence on the part of the cultivators or by any deliberate practice of loading cattle across them should be discouraged. Besides, all cases of damages to field channels should be promptly reported by the villagers to the Irrigation officials for timely attention. The village panchayats can play a very effective role in these matters. A suggestion has also been made that panchayats should levy a cess for the lining of the 'gules' within their villages, without having to rely on the Government's resources. The approach to the solution of problems like these, through village panchayats has already been accepted at the all-India level. It is now a matter of implementation of the policy so as to cover all aspects of construction and maintenance of field channels, including the portions that the cultivators are supposed to construct.

8.39. *Land Acquisition for Field Channels.*—Land needs to be acquired by the Government for the construction of portions of the field channels. We were told in one area that 1.75 acres of land would be used up for the construction of only one mile of field channel. At this rate, the land to be acquired for a tube-well may easily be more than 4 acres. In U.P., at least, land acquisition has been a serious difficulty faced by the Irrigation Department. The procedure for land acquisition is very lengthy. Since a number of cultivators are involved, sometimes from a number of villages, it takes three to four years and in some cases even six years before the land is finally handed over to the Irrigation Department. The following table shows for the two blocks under study the areas for which land cases were sent by the Irrigation Department and the progress made till the date of enquiry in respect of land acquisition.



TABLE 8.10  
*Progress in the Disposal of Land Acquisition Proceedings in Sample Blocks in U.P., by Years.*

Year	Deokali Block						Mardah Block				
	No. of tube-wells	Area to be acquired for which land cases were sent (acres)		Percentage to Col. 3		Area pos- sion of which handed over to Irrigation Department	No. of tube-wells	Area to be acquired for which land cases were sent (acres)		Percentage to Col. 8	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1953	..	7.9	100.0	100.0	0.0	2	7.6	100.0	93.7	90.0	..
1954	..	6.0	100.0	97.2	0.0	1	5.2	100.0	100.0	0.0	..
1955	..	1.5	100.0	0.0	0.0	6	28.8	100.0	99.2	22.0	..
1956	..	9.0	100.0	40.0	0.0	2	9.1	100.0	100.0	0.0	..
1957	..	2.1	100.0	0.0	0.0	0	—	—	—	—	..
1958	..	39.4	100.0	74.0	0.0	2	4.9	100.0	100.0	0.0	..
1959	..	2.6	100.0	100.0	0.0	0	—	—	—	—	..
1960	..	4.0	100.0	100.0	0.0	0	—	—	—	—	..
N.A.	..	3.3	100.0	100.0	0.0	0	—	—	—	—	..
TOTAL	..	75.9	95.2	74.4	0.0	13	55.6	100.0	98.7	23.7	..

It will appear from Table 8.10 that actual possession has not been handed over to the Irrigation Department till the time of investigation in 1961 for any of the 76 acres of land for which acquisition cases were sent by them in Deokali block in the years since 1953. Even notifications under Section 6 had been issued for only about 74 per cent of the areas required. In Mardah block, the position is slightly better in the sense that 24 per cent of the total land required for acquisition had been handed over to the Irrigation Department within a year or two of the proceedings. Notifications had also been issued for all the land involved. But 76 per cent of land was still under dispute. Most of the land was needed for tube-well constructed in the First Five Year Plan, only two of these wells having been installed in the third year of the Second Plan. According to the Irrigation authorities, this delay in land acquisition is one of the major obstacles in the way of full utilization of the irrigation potential of the tube-wells. The practice in the past was that the Irrigation Department went ahead and constructed channels wherever it was possible for them. That is why most of the tube-wells installed earlier did have lined or unlined 'gules', even though possession of land has not been handed over to the Department even now. This procedure led, however, to several disputes and court cases, so that the Department had later to give it up. There will be no two opinions that the Irrigation Department should be empowered or allowed to construct the field channels immediately after the alignments are fixed and thus enable to cut short the time-lag between the completion of the tube-well and the construction of the distributary field channels. Land acquisition for the channels should precede the completion of the tube-wells; and proceedings for this purpose should be drawn up much before the well is completed. It may be considered in this connection, if the powers for acquisition can be delegated to the Irrigation officials.

#### ROTATION SYSTEM/WARABANDI/OSARABANDI ETC.

8.40. A system of rotation is generally followed in the matter of distribution of tube-well water. The rotation system is theoretically there in Punjab. But in actual practice, there are departures and deviations. Thus, it has been reported from the sample blocks in Punjab that influential persons get more supply of water than ordinary cultivators. The operators of the tube-wells are somewhat helpless against the influence of such cultivators. The villagers were asked about their suggestions for the improvement of the present state of affairs. They suggested that the newly constituted panchayats should be made responsible, *inter alia*, for implementation of the water rotation as fixed by the Irrigation Department. A separate management committee with the operator associated with it may be formed for each tube-well for this purpose.

8.41. In U.P., there is the 'Osarabandi' system for the distribution of water. The whole of the area commanded by a State tube-well is divided into convenient blocks (or 'Thoks') about 8 to 12 in number. For each 'Thok', a man of influence and integrity is nominated the Thokdar with the general consent of the cultivators in the 'Thok'. Each 'Thok' will have its turn for water once in 14 days on an average. The period allotted in each rotation is calculated in proportion to the area comprised in the 'Thok', and may vary from 7 to 21 days. If, however, cultivators in a particular 'Thok' (A) do not desire to have water at the time allotted to it or stop taking water, the water shall be offered to the 'Thok' next in turn till the time of the 'Thok' (A) elapses after which the next 'Thok' will be

given water according to the 'Osarabandi' chart. The Thokdar is responsible for the distribution of water among the cultivators within a 'Thok'. He decides as to who should receive water during each period of rotation and the order in which they should take it. The number of hours for each cultivator is decided by him in consultation with the cultivators themselves on the basis of the area of each cultivator.

8.42. Perhaps, the only short-coming in the 'Osarabandi' system relates to the periodicity with which the turn of an individual cultivator comes. It is generally a fortnight and, therefore, the system is not suitable for cultivators growing crops requiring water at more frequent intervals. In other words, the cultivators may not get water according to their effective demand. According to the State Government, however, the 'Osarabandi' rules permit variation of the rotation period from 7 to 21 days, depending upon the wishes of the majority of the cultivators. These deviations from the routine pattern, occur in actual practice rather rarely. If there is a closure of the tube-well due to mechanical or other defects, the 'Osarabandi' is correspondingly extended to more than two weeks. Contingencies of this nature, of course, damage the standing crops if they require more frequent watering. Anyway, the Irrigation Department of the U.P. Government are of the view that the 'Osarabandi' system is an outcome of 25 years' experience of distribution of water and that it does not seem possible to modify the distribution system to suit the needs of individual cultivators.

#### WATER CHARGES

8.43. Charges for the use of irrigation water from the tube-wells in U.P. are based on the units of volume of water distributed. The sale of water on a volumetric basis has a number of advantages, and encourages economy in the use of water. The rate charged is 16,000 gallons per rupee (for all crops) except paddy and except for 'Palewa' irrigation in October, for which only one rupee is charged for 30,000 gallons. For a number of years, a rebate of As. 3 in a rupee (or 19 per cent) was allowed on irrigation charges in U.P. This rebate applied to the charges of tube-well water except for paddy and for 'Palewa' irrigation. This rebate was originally given as a relief measure in a bad year and continued subsequently at the expense of the State exchequer. Its withdrawal will help the operation of the tube-wells on the financial side. Table 8.11 gives the cost of tube-well irrigation per acre for the different crops as calculated by the Irrigation Department in U.P. An attempt has been made in this table to compare the tube-well irrigation charges with the canal rates in the same area.

TABLE 8.11

*Tube-well and Canal Water Rates Estimated for the Irrigation of Different Crops in Saharanpur District*

Item	Sugarcane	Paddy	Wheat	Peas	Fodder crop
(1)	(2)	(3)	(4)	(5)	(6)
Depth required .. .. .	6"	8"	4"	4"	4"
Gallons required (per acre) .. .	1,00,000	1,25,000	60,000	60,000	60,000
Cost (gross) per watering in rupees	6.25	4.17	3.75	3.75	3.75

TABLE 8.11—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)
Cost (gross) calculated on the basis of no. of times irrigations done (Rs.) .. .. .	31.25	25.02	11.25	11.25	7.50
Net cost to cultivators (Rs.) + 20%* (excluding paddy) allowance .. .. .	37.50	25.02	13.50	13.50	9.00
Canal rate (Rs.) .. .. .	32.00	14.00	12.00	9.00	3.00

\*An increase of 20% is justified because (a) the actual requirements of crops differ from those derived from the formula used by the department, (b) the cost of carrying the water from the source to the field is borne by the cultivator which is substantially higher for the fields located at a distance from the source.

It will appear from the figures in Table 8.11 that the cost of tube-well irrigation is higher than that from canals in the same area. If we compare the average rates to be paid by the cultivators for tube-well irrigation of different crops with those charged for canal water in Saharanpur, the disparity appears most marked for fodder and paddy crops. It is three times for fodder crops and almost double for paddy. This wide disparity in the same area between the rates of the two sources of irrigation owned by the State, is a matter of some concern.

8.44. As a solution to this problem, the U.P. Government are considering a proposal for levying a fixed basic irrigation rate or cess on the whole of the commanded area and then realising a surcharge on the basis of the volume of water sold for various crops. This proposal, if it is accepted, will lead to lower "water rates" which will go a long way to encourage and extend the utilization of tube-well irrigation. Another suggestion that has been offered in this connection is to charge differential rates for irrigation during day and night. At present, since the cultivators have to pay the same water rates whether they irrigate the fields during the day or at night, and since it is inconvenient to work at odd hours during the night, night irrigation is not preferred by the farmers. But the electric load is much heavier during the day than at night. If electricity is offered at concessional rates during the night for tube-well irrigation and the concession is passed on to the cultivators, it may give them an incentive to utilize water during the night. This should prove financially helpful to the Tube-well Authority as well as the Electricity Department. The only objection to the suggestion is that it will give too much of a lever in the hands of tube-well operators, which is likely to be abused by them. The only solution to problems like this is again the reliance on local institutions of the people. As and when panchayats become strong and can undertake to discharge such responsibilities, the prospects for the economic operation of tube-wells will improve.

8.45. In the Punjab, tube-well water is sold to the cultivators not on a volumetric basis but according to the units of electricity consumed. The rate per unit was lowered to As. 2 in 1960; and this gave a boost to the use of tube-well water. The rate of As. 2 was, however, considered low and has been raised to As. 2.6 per unit in 1961. It works out to Rs. 1-8-0 per hour at the rate of 10 units per hour. A handicap with this system is that the cultivator pays for electricity but not necessarily for water. He has to pay the same rate even when the discharges are falling. The Study Team of the COPP has commented that

in some tube-wells this has happened already. "In the case study of Tube-well No. 10 in Ghazipur village of Rajpura area, the discharge has fallen to almost half of the normal discharge and the rate has correspondingly gone up. As a result, the cultivators are reluctant to use tube-well water".\* It appears that the U.P. system for the sale of irrigation water from tube-wells is better than that prevailing in Punjab.

#### ORGANISATIONAL AND ADMINISTRATIVE DIFFICULTIES

8.46. Some of the organisational and administrative problems noticed in the course of our field investigation will be briefly referred to in this section. It has been observed that the present strength of line-men in Punjab is not considered adequate for the efficient discharge of their duties. A suggestion has been made by the knowledgeable people in the sample blocks that a line-man for every 15—20 tube-wells should be located at a central place and within easy reach, and that the Electricity Board should make arrangements for attending to the line faults in time and for immediate replacement of the fuses, transformers, etc. Another suggestion received by us is that the jurisdiction (in number of tube-wells) of one mechanic may be reduced from the present level. About the operator, complaints are quite frequent that he hardly remains on duty all the working hours. Though the operators have been provided with residential accommodation near the tube-well in most places, they sometimes entrust their job to some cultivators who roughly record the number of units consumed against the users. Practices like this result in many avoidable complaints. The grant of a bonus to the operator may induce the operator to work full time. Such a proposal is reportedly under consideration by the State Government. The enforcement of a pucca (permanent) rotation system, the formation of Management Committees at the village level and the bringing of the panchayat into the system are some of the lines of solution already discussed. In view of the unprofitable operation of the tube-wells, these may be better than attempts to pay more to the operator through bonuses.

8.47. In Saharanpur district (U.P.), it has been observed that the tube-well operators do not now take as much extra pains as they used to, to popularise tube-well irrigation among the cultivators. Perhaps this is because the department sometime back used to pay to the operator a certain percentage of revenue realised as commission, but later this inducement was withdrawn. Panchayats and Management Committees may help in creating in them better interest in and sense of responsibility for the job.

8.48. It has been observed in some areas of Ghazipur that the Irrigation Department, on the one hand and the Agriculture Department and the Block authorities on the other, have somewhat different views about the factors behind under-utilization of tube-wells. The irrigation authorities consider two factors—delay in the land acquisition for 'gules' and almost insignificant change in the cropping pattern to be holding up irrigation development. On the other hand, the Agricultural authorities think that as the Irrigation Department have given priority on irrigation to sugarcane, it has not been possible for the extension agency to sponsor new schemes such as sowing of moong type I, maize and barseem in the early period of Kharif. If the cultivators are induced to irrigate late paddy and sow even khosari or peas by the broadcast method while the late paddy crop is standing, there may, according to this view, be a solution to the problem of under-utilization. The solutions considered by the two sides are not so important

\*Page 19 of the COPP Team Report on State Tube-wells in Punjab, January, 1962.

as the difference between them is a matter of common concern. It is learnt that the State Government have formed a Potential Assessment Committee, at the district level consisting of Executive Engineer, District Planning Officer and District Agricultural Officer, to assess the extent of potential created and potential utilized in the district. It is hoped that this step may go a long way in bringing about a meeting of minds between these departments and laying the basis for a co-ordinated approach. We may emphasize here the need for giving more of responsibility to the Agriculture Department for developing the command area of tube-wells.

#### COOPERATIVE TUBE-WELLS IN U.P.

8.49. An attempt was made by us to collect through the consensus method the views of the knowledgeable farmers in the sample villages, about the working of the cooperative tube-wells in Saharanpur district. The points that emerged clearly and conclusively are given below :

- (a) The motive power used in all the cooperative tube-wells is derived from diesel engines and as such is more expensive than electricity.
- (b) None of these tube-wells have pucca field channels; nor were any channels constructed for them by the Government.
- (c) Not a single one of these tube-wells is functioning properly.
- (d) Even the office-bearers of the cooperatives admit failure of this scheme and would like the tube-wells to be taken over by the Government and/or be electrified.
- (e) None of these tube-wells have been maintaining any record since 1956-57.

These views represent the consensus among the knowledgeable farmers and are not based on any field enquiry by us into the working of the cooperative tube-wells.

8.50. The views noted above give a rather dismal picture of the working of the cooperative tube-wells. On enquiry from the State Government, we came to know that the question of acquiring these tube-wells and bringing them up to the standard of the State tube-wells were under their active consideration. It has been reported that 57 cooperative tube-wells have so far been taken over by the Irrigation Department. There is also a proposal of taking over 100 such tube-wells during the current financial year, if they are found, after testing and examining, to be of the requisite standard and if the cooperative societies owning them are willing to hand them over to the Irrigation Department.

#### RECORDS OF AREA IRRIGATED

8.51. The figures of area irrigated by State tube-wells are based on detailed records maintained by tube-well operators. While an adequate system exists for maintaining proper figures about areas irrigated, how far these are comparable with data kept by other sources remains a moot question. There have been instances when different departments have reported differently for the same item. For illustration, in Deokali and Mardah blocks (U.P.), the figures of area irrigated by tube-wells (by 18 and 13 State tube-wells respectively) as reported in the Block records are higher than those given

in the records of the Irrigation Department, as will be apparent from the data given in Table 8.12.

**TABLE 8.12**

*Area Irrigated by Tube-wells in Sample Blocks in Ghazipur district (U.P.), as Reported by Different Agencies*

Agency reporting	Area irrigated by tube-wells (acres)				
	1959-60	1958-59	1957-58	1956-57	1955-56
(1)	(2)	(3)	(4)	(5)	(6)
<b>DEOKALI BLOCK</b>					
Block .. .. .	4,700	4,300	3,870	2,860	2,350
Irrigation Deptt. .. .. .	3,882	3,961	2,412	1,164	1,300
<b>MARDAH BLOCK</b>					
Block .. .. .	4,800	4,800	4,800	4,700	N.A.
Irrigation Deptt. .. .. .	3,303	1,994	3,29	1,319	N.A.

8.52. Cases have come to notice where the records are not brought up-to-date. In one of the selected villages in Mardah block where about 10 acres received irrigation from two tube-wells last year, the areas were not shown against this source in the Revenue records. Instead this area was recorded as being served by old masonry wells which used to irrigate this piece of land before the introduction of tube-wells. It may be added that no distinction seems to be made between the areas newly brought under irrigation by tube-wells and those which were irrigated previously but precariously, by other sources. In the sample villages in Ghazipur district, only about 40 per cent of the area irrigated by the tube-wells can be considered as areas newly brought under irrigation.

## CHAPTER IX

### SUMMARY AND SUGGESTIONS

#### *Summary of the Findings*

#### OBJECTIVES AND METHOD OF STUDY

9.1. The objectives of this study are to examine the nature, use and growth of minor irrigation works and facilities, to analyse the problems of utilization and extension of the existing facilities, of their maintenance and administration, and to assess their impact on the use of water and the cropping pattern since 1955-56. The study is based on the results of field investigations in 14 States, from each of which one or more districts were selected according to the number of sources of minor irrigation deemed important in the area. Two blocks were selected randomly from each district, three villages similarly from each block, and 10 cultivator households from each village on a random basis, and five to six knowledgeable persons purposively. Field data have thus been collected from 1,255 cultivator households and 702 knowledgeable persons in 126 villages in 42 blocks of 21 selected districts in 14 States. The findings of the field survey are representative strictly speaking, of the conditions in the districts selected in each State.

#### HISTORICAL BACKGROUND

9.2. Official recognition of the importance of minor irrigation to the cultivator in India goes back to the Royal Commission on Agriculture (1928), if not, earlier. The available statistics show that in 1920-21, 59% of the irrigated area in the country were served by the minor works. While no generalization can be made on the basis of the available data, it seems that the minor sources have tended to maintain their relative importance in the last two decades. The nature and importance of these sources of irrigation, however, vary considerably among the States. In Punjab, Bombay, Madhya Pradesh, Rajasthan and U.P., more than two-thirds of the area under minor irrigation are served by wells, while in the southern States except Kerala and in Orissa, tanks cover 57 to 74% of the area served by such works. The construction, maintenance and improvement of these minor works had not received as much attention from the Government as they deserved, at least till the launching of the Grow More Food Campaign in 1942-43. Works costing less than Rs. 10 lakh are now categorized as minor works.

#### MINOR IRRIGATION AND THE FIVE YEAR PLANS

9.3. *First Plan Target and Achievement.*—While the Planning Commission has been emphasizing, since its inception, the role of minor irrigation in stepping up the production of foodgrains, the urgency of the programme seems to have received increasing attention in the course of the Second Plan. In the First Plan, a total outlay of about Rs. 85 crore was originally provided for the minor irrigation programme. Against a target of 11.3 million acres of *additional* area to be brought under minor irrigation, the area actually benefited in the First Plan period was estimated at about 9.5 million acres.



9.4. *Second Plan Target and Achievement.*—The Second Five Year Plan provided for a target of 9 million acres of *additional* area to be served by the minor sources. For 4.5 million acres, the outlay originally provided was of the order of Rs. 66 crore under the agricultural programmes. For the remaining 4.5 million acres, the provision was to the tune of Rs. 55 crore (including the provision for land reclamation) under the Community Development programme. As a result of the re-appraisal of the Second Plan in 1958, the allocation on minor irrigation under the agricultural programme was raised to Rs. 92.64 crore. The Working Group on Minor Irrigation estimated in 1959-60 that the overall target of bringing 9 million additional acres under minor irrigation was expected to be fully realised during the Second Plan period. Though there might be a shortfall of 1.5 million acres in achievement under the C.D. sector, it was expected to be compensated by an excess of the same order under the Grow More Food schemes.

9.5. The physical achievement in respect of minor irrigation during the first four years of the Second Plan had been of the order of 86% of the target. The achievement ratio shows a wide variation among the States, ranging from 31% in Kerala to 176% in Rajasthan. On the financial side, the expenditure during this period in the States and Union Territories amounted to Rs. 72.33 crore on schemes under the GMF programme and Rs. 34.28 crore on this head under the C.D. programme. The ratio of this expenditure to the revised Plan outlay works out at 72.2%, whereas the corresponding achievement target ratio is much higher, 86.5%. The disparity between these two ratios is much wider in some of the States.

#### MINOR IRRIGATION AND THE C.D. PROGRAMME

9.6. The Srinagar Conference on Community Development, 1960, recommended that in future two-thirds of the provision for agriculture, minor irrigation and land improvement in the budgets of the C.D. blocks should be generally earmarked for the minor irrigation programme. In the States of Andhra, Bihar, U.P., Rajasthan, Orissa, Madras and Mysore, minor irrigation accounted for more than two-thirds of the provision in the C.D. budget, while in States like Assam, Kerala and West Bengal, it amounted to less than two-thirds of the total provision under the relevant heads, all through the Second Plan period. In West Bengal, while the provision for minor irrigation programme had been below the standard prescribed at the Srinagar Conference, even the smaller provision was not fully utilized. In some States, the amount spent was in excess of the annual provision and might be explained by the procedural flexibilities allowing for reappropriation among the budget heads under agriculture and the carry-over of the unspent amount from one year to the next.

#### COST OF EXTENSION OF MINOR IRRIGATION WORKS PER ACRE IRRIGATED

9.7. The cost of extension of minor irrigation has increased over the years. The First Plan outlay works out to an average cost of Rs. 76 per acre as compared to Rs. 134 in the initial and Rs. 164 in the revised Second Plan provision. In the Second Plan, however, the actual cost per acre of extension of minor irrigation is expected to work out to a lower figure (Rs. 150) than what can be derived from the revised outlay (1958) figure.

## USE OF MINOR IRRIGATION FACILITIES AND THEIR IMPACT

9.8. *Use and Ownership of Minor Works.*—The proportion of minor irrigation works in use to the total in the sample was nearly 88% in 1960-61, the lowest proportion in use (83%) was found in the case of kutchha wells, and the highest (100%) in the case of tube-wells and pump sets. For pucca wells and tanks, the proportion in use were 92 and 95 per cent respectively. Wells which are the most numerous among the works, show the highest proportion out of use, and more so, the kutchha wells. Further, the proportion of wells, pucca or kutchha, in out of use state is higher for the jointly owned ones. The proportion of tanks in out of use state for the entire sample comes to only 5%; but figures for the States of Andhra and Madhya Pradesh are 10 and 12% respectively. The relatively high figures for some of the States may be due, at least partly, to the vesting of the zamindari tanks in the respective State Governments.

9.9. Wells are, except for a negligible proportion, privately owned works, the ownership being either joint or single. Tanks, however, fall under private, institutional and Government ownership. It is only in U.P. where nearly 91% of the sample tanks were found to be under panchayat ownership in 1960-61, that panchayats emerge significantly in the ownership of tanks. About 83% of the tanks in West Bengal and 68% in Kerala were under private ownership, while 94 to 100% of these were under Government ownership in Andhra Pradesh, Madras and Mysore, in 1960-61. The interest in the use and maintenance of minor works by the user seems to decrease with the social distance separating him from the owner.

9.10. *Coverage by Irrigation Works.*—The number of kutchha and pucca wells comes to about 1.4 per 100 acres of net cultivated area in the sample villages. Tanks and other sources are numerically smaller. In the sample areas, a pucca well, on an average, can cover 6.1 acres, a kutchha well 1.4 acres and a tank 31.3 acres of irrigable area.

9.11. *Growth of Minor Works.*—Between 1955-56 and 1960-61, the number of tanks in the sample areas had increased by 2.4%, pucca wells by about 28%, tube-wells by about 29%. Pump sets, however, recorded a growth of nearly three and one-third times. The proportion of wells under construction or near completion was 2.2% for pucca wells and 8.8% for tube-wells. The figure of the kutchha wells under construction in the sample areas as on the date of investigation in 1960-61 shows a much higher rate, about 8.1%, than that for pucca wells.

9.12. *Utilization of Irrigation Potential.*—Taking the sample area as a whole, about 29% of the net cultivated area could be covered by the minor irrigation works, and 40% by all works (major and minor) existing in the villages, as on the date of enquiry. Among the States, the percentage of the net cultivated area covered by minor works varied from 85% in the Punjab to 6% in Kerala. Not all of the area, however, which could be irrigated by the existing minor works was actually receiving the irrigation benefit. About 54% of the irrigation potential of these works remained unutilized in the Kharif season of 1959-60 as compared to 31% in the Rabi. Even then, the weighted average of utilization over the two seasons of 1959-60 was considerably higher for minor works than that for canals in the sample areas of Andhra, Madhya Pradesh, Punjab, Rajasthan and U.P. where minor works coexisted with canals. Tanks are used predominantly for Kharif

irrigation in Andhra, Mysore, Orissa and for Rabi in Madras and Kerala. The extent of their under-utilization was high in the Kharif season particularly in Orissa (62%); but in the Rabi the potential was almost fully utilized. Utilization of the potential of wells was higher in every State in the Rabi season than that in the Kharif, the only exception being Punjab. On the whole, there is evidence to show a considerable degree of under-utilization of the irrigation potential of the minor works, which is contrary to the general notion.

9.13. *Impact of Irrigation.*—The study reveals an increase in the cultivated area as well as in the areas newly brought under cultivation in the sample villages. The former rose by 8% during the period 1955-56 to 1959-60 and the later from .02% of the cultivated area to 0.3%. The area reclaimed also rose during this period. The proportion of the gross cropped area irrigated from all sources increased from 23.6% in 1955-56 to 25% in 1958-59, and stood at 24.8% in 1959-60. The proportion of the cropped area receiving irrigation benefit in the Kharif remained more or less the same between 1955-56 and 1959-60. But, the figure of Rabi irrigation showed a rise from 14 to 17%. States like Punjab, Bihar, and Andhra recorded substantial increases, while Rajasthan and U.P. showed a decline in the proportion of Rabi acreage irrigated.

9.14. *Intensity of cropping* has been found to be higher in the irrigated tracts than in the unirrigated ones in the sample. The extent of multiple cropping had gone up by nearly five points between 1955-56 and 1959-60 in the irrigated areas, from 31.0% to 36.2%. The unirrigated areas showed no such change. Over this period, the share of paddy in the total gross cropped area recorded an increase from 19.3% to 21.6%. A perusal of the State-wise figures reveals that the rise in the share of paddy occurred not in States like Andhra and Orissa where its share in gross cropped area was already high, but in States like Punjab, Mysore and U.P. Better irrigation facilities resulted partly in a switch in acreage in favour of paddy, and partly in the direction of greater irrigation on the existing areas under some of the cash crops like cotton and groundnut, and of foodgrain crops like paddy.

#### COMPARISON OF ESTIMATES DERIVED FROM DIFFERENT SOURCES, OF THE EXTENT OF MINOR IRRIGATION

9.15. The estimate of the intensity of cropping derived from the random sample of households was in close agreement with that obtained from the village level data for the year 1955-56, but was higher for the year 1959-60. A comparison of the estimates of the 'proportion of net area irrigated to net cultivated area', derived from household data and from village records revealed that the village level data tended to under-estimate the extent of minor irrigation and probably its increase over this period. The estimate of this proportion, as given in the village records was also compared with that derived from the aggregated data for the minor works existing in the sample villages. This comparison revealed a close agreement between the two sets of estimates (of the proportion of net cultivated area irrigated) in respect of sources like tube-well, pump set and also tank. The estimate derived from the aggregated data for the works was somewhat higher than the patwari figures show in respect of wells, and much more so for the residual group of 'other sources'. There is evidence to show that in a

number of States, the village level data tend to under-estimate the extent of net irrigation provided by the minor works; while in some other States the evidence is somewhat on the other side. The net result seems to be under-estimation for the country as a whole as far as can be judged or generalized from our sample.

#### PROBLEMS OF UTILIZATION OF MINOR IRRIGATION FACILITIES

9.16. *Size of Works and the Utilization of Potential.*—An attempt was made to find out whether the extent of utilization of irrigable capacity was related to the size of minor works. The data did not show any inverse relationship between the size of a work as measured in irrigable acreage and the extent of utilization of the potential in the Kharif season in the case of tanks, except for tanks with an irrigable area of about 200 acres. In the Rabi season, the utilization as a proportion of the overall potential showed a tendency to go up with the irrigable area of tanks from size of 50 acres and above.

9.17. In the case of wells the utilization of the potential was found to be very low, almost negligible, in the Kharif season in Bihar, but very high in the Gujarat area. In the Rabi season, the wells were usually utilized to a larger extent in all the areas. The available evidence tends to show that the utilization of the irrigation potential in the Rabi season of 1959-60 was lower in wells of large size in terms of the irrigable area.

#### DIFFICULTIES IN THE WAY OF FULL UTILIZATION

9.18. Under-utilization of the potential of tanks is caused very largely by their physical condition. Nearly 47% of the tanks were under-utilized in 1959-60 on this account. Nearly 21% of the tanks were found to be losing water because of delay in urgent repairs on breaches that have occurred recently. Consequently, these were not in a position to achieve their full potential. In another 4% of the tanks, water was being lost because of the inadequate or unsound nature of the weirs or outlets. Thus there was wastage of water in about one-fourth of the tanks; and this wastage stood in the way of achievement of the full potential. In another 21%, either the lifting devices were not installed or the lifting of the water was too costly. Locational disadvantages such as works located close to one another, or tanks not needed for irrigation because of adequacy of rainfall, come next in order of importance among the factors behind under-utilization.

9.19. In the case of wells location is the most important factor influencing utilization. This was reported in one form or another by 65% of the cultivators in the random sample and 52% of those in knowledgeable persons' sample. About one-half of the respondent cultivators did not need the water to the extent available in their wells. Numerically, the most important reason given for this lack of need for the water was that the capacity of the works was larger than the needs of the owned. This, combined with another reason namely, that 'there was no demand for water by others', shows the existence of surplus capacity and over-capitalization. Other reasons adduced were the economic condition of the cultivators, unwillingness of owners to share water with others, etc.

9.20. *Adequacy of Supply of Irrigation Water.*—While some of the works remained under-utilized, about 80% of the respondents both in the

random sample and in the knowledgeable group mentioned that 'they did not get enough irrigation water'. There was complaint about shortage of water in the works caused largely by silting, bad state of repairs, neglect of maintenance, lack of boring facilities, etc. Another factor which comes out pointedly is that the location and spacing of the works had been acting as a limitation on the supply of water. About 34 to 35% of the responses of the cultivators indicated that their plots were outside the irrigable area of the minor works. On the other hand, about 8 to 14% of the respondents had maintained that the works were located too close to one another. An analysis of the responses showed that topographical difficulties stood in the way of a larger coverage by the existing works in some areas. In other areas where locational problems had been mentioned, the closeness of spacing of the wells stood in the way of fuller use of water from the existing sources. To the extent this is true, works like wells have not been sited or spaced by the individual owners keeping in view the larger needs of the neighbour-cultivators or of the community.

9.21. West Bengal, Kerala and, to some extent, Bihar are the areas where non-existence of irrigational source is very largely the reason for the reported inadequacy in the supply of water. Assam, Madhya Pradesh, Orissa, Rajasthan, and, to a certain extent, Madras are the areas where location of the irrigation works in relation to the fields of the cultivators is a very important reason for the inadequate availability of water by the respondents. This factor, however, has been reported in varying proportions by the respondents in all the States except Gujarat, Kerala, Punjab, Maharashtra and to some extent, West Bengal. In all the States except Punjab and Assam, and to some extent Rajasthan, shortage of water in the works seems to be the most important reason for the inadequate supply of water reported by the respondents. Inadequate and irregular maintenance of the irrigation works emerge, therefore, in many of the States as the most important factor behind the shortage of irrigation water reported by the respondents.

9.22. The availability of water from the minor sources was not considered sufficient even for lands enjoying irrigation facilities from them by a fairly high proportion of the cultivators.

9.23. *Suggestions for Solving the Problem of Inadequacy of Water.*—The suggestions of the respondents about ways of removing this difficulty mainly related to reconstruction, renovation and improvement of the existing works. Suggestions designed to improve the repair and maintenance aspect and to enforce a better method of distribution accounted for only about one-fifth of the responses. The respondent-cultivators were, on the whole, less inclined to solve the problem through the construction of new works.

9.24. *Enforcement of Prescribed Cropping Patterns.*—Instances have been reported from Maharashtra about divergence between the views of the Irrigation authorities and the preferences of the cultivators in respect of cropping pattern. Such divergences adversely affect the utilization of the potential of the larger minor works like big tanks and bandharas. Kharif crops are usually given a very low priority by the cultivators in their scale of preference for irrigation, while these have been placed very high in the scale prescribed by the Irrigation Department.

## INADEQUACY OF SUPPLY OF WATER AND ITS EFFECT ON THE CROPPING PATTERN

9.25. Inadequate supply of irrigation water had particularly affected the irrigation of paddy and wheat crops. The respondent cultivators reporting their inability to irrigate the paddy crop on account of the inadequacy of water were largely from the sample areas in Orissa, Bihar, Andhra, Madras and West Bengal. The respondents reporting inability on similar account to irrigate the wheat crop came largely from Bihar, U.P., Madhya Pradesh and Punjab. Cotton, pulses and sugarcane were among the other crops that also suffered on this account.

9.26. Of the cultivators in the random sample, reporting inadequate supply of water, about 60% stated that they would have introduced some new crops if there had been enough water. The crops very largely preferred by such respondents were, in order of preference, sugarcane, vegetables, paddy, potato, cotton and wheat.

### FIELD CHANNELS

9.27. Time-lag in the construction of field channels has not been reported to be an important problem in any of the sample areas, except Rajasthan. More than two-thirds of the respondents considered the existing field channels adequate and satisfactory. The main difficulties in the way of extension of field channels appeared to be lack of cooperation among the cultivators and inadequacy of their finances.

9.28. Two other problems have also been reported to be affecting the utilization of the irrigation potential. In Maharashtra, inadequate levelling of fields seems to have been a baffling problem so far. Temporary allotment of lands has also been a factor affecting fuller utilization in Rajasthan.

### WATER RATES

9.29. The data collected in the course of the enquiry show that in Gujarat and Andhra, canal irrigation is considerably cheaper than well irrigation not only for the wet crops but also for the lightly irrigated crops. The cost of well irrigation in these areas is between four and six times that of canal irrigation. In U.P., the cost of irrigation from State tube-wells is higher than that from canals for all the crops and is more so for paddy.

9.30. The optional or contractual nature of the agreement between the Government and the cultivators is a factor affecting full utilization particularly from embankment and diversion weir projects in areas like West Bengal.

## NATURE AND PROBLEMS OF MINOR IRRIGATION IN AREAS SERVED BY MAJOR PROJECTS

9.31. Some of the minor irrigation works within the command of new major projects like Malampuzha (Kerala), Matatila (U.P.), Barwala Branch of Bhakra Nangal (Punjab), have gone out of use. On the other hand, in the command areas of some of the other new major projects, minor works are being used to supplement canal water for irrigating vegetables and

perennial crops like sugarcane, banana, etc. in seasons when canal water is not available or is inadequate. The complementary nature of minor works in the areas of Kakrapar Project (Gujarat), and Gangapur Project (Maharashtra) is indicated by the fact that though water rates are charged by the Government if new wells and tanks are constructed within 200 yards of the Government water course, the cultivators are willing to pay these water rates and sink new wells.

9.32. The policy of some State Governments to suspend the minor irrigation extension programme within the command areas of the new major projects has resulted in the neglect of the existing works even though the cultivators there have a marked desire for irrigation from them.

#### PROBLEMS OF EXTENSION OF MINOR IRRIGATION FACILITIES

9.33. About 56% of the responses suggest physical problems standing in the way of creation of new works and facilities in the sample villages. The most important of these problems are lack of electricity and low water table. The first has been reported mostly from Andhra and Punjab, and the last difficulty from Rajasthan, Mysore and Maharashtra. In the latter areas, sinking of wells is very costly and uncertain because of the low water table. Shortage of electricity has generally been felt by those who desired to instal pump sets. Lack of finance is another important hurdle.

#### COST OF CONSTRUCTION AND ROLE OF FINANCIAL ASSISTANCE

9.34. The cost of construction of both pucca and kutchha wells shows a wide variation among the States. Similar variation has also been noticed in the cost of construction per acre of irrigable area by the wells. The cost data tend to show that kutchha wells are not really cheap when one assesses their unit cost in terms of irrigable acreage. Further, the sample data do not show conclusively that wells constructed with financial aid have been significantly larger in size in terms of irrigable area. Whether this is so because financial aid was not substantial or because the size of the work was determined by other considerations, cannot be conclusively analysed on the basis of the available material.

9.35. Aided kutchha wells, i.e. those constructed with financial assistance from the Government accounted for about two per cent of the total wells in the sample; and the area actually irrigated by them in 1959-60 constituted about 4% of the gross irrigated area. Aided pucca wells accounted for about 9.8% of the total wells in use and the area irrigated by them formed about 10.1% of the gross irrigated area. These data suggest that the area actually irrigated per work for the aided wells was probably larger than that for the unaided wells, thereby indicating relatively higher utilization from the aided wells, even though these were not different in size from the unaided ones. In the Rabi season of 1959-60, however, the aided wells—kutchha and pucca both—irrigated less than the unaided ones.

9.36. The standard life-time assumed by the State Governments for different types of minor works varies among the States. For many of the States, these norms compare well with the data derived from our sample. Our observation in many areas indicates that the distinction between kutchha and pucca wells is neither very clear and rigid nor perhaps, scientific.

## FARMERS' PLANS FOR EXTENDING IRRIGATION

9.37. About 19% of the cultivators and 30% of the knowledgeable farmers reported that they had plans to extend their area under irrigation through the creation of new works or renovation of the existing ones. A very small proportion of the respondents reported having plans for tanks. Those who favoured tanks came from the relatively more progressive and well-to-do classes. The percentage assistance required varied slightly between works of construction of tanks and works of other types. The overall assistance desired by the cultivators was of the order of 99% and by knowledgeable persons about 81%. Construction of wells got the highest priority in the plans of the respondent cultivators for the creation of new works. Further, assistance was desired by the respondents to the extent of about 60% of the costs of such works. The proportion of assistance desired for the reconstruction and renovation operations on the existing works (66%) appeared higher than for the construction of new ones (59%). Financial difficulty loomed larger among the respondents in the way of execution of their plans.

## STANDARD OF COST AND RETURNS FROM MINOR WORKS

9.38. The consideration that seems to have weighed heavily with the State Governments on the question of returns from the minor works is ability of the works to irrigate food crops. In Gujarat and Maharashtra, the norms lay down that about 60% of the area to be irrigated should be under food crops. Punjab and Madras have laid down standards in terms of yields. Besides, standards of financial outlay per acre of the irrigation potential created are also prescribed. In some other States, the standards for returns are thought of in terms of a minimum percentage return on the capital outlay. Mysore generally insists on a two per cent return in the case of works costing Rs. 50,000 or less and 3% in the case of works costing more. For restoration, however, the restriction of 2% is relaxed.

## PEOPLE'S CONTRIBUTION

9.39. It has been reported that the practice of insisting on a certain percentage (not necessarily 50% or 25% or any figure) of the cost of community or group works as people's contribution is holding up progress in the creation of new minor works in some areas. The policy of insisting on a reasonable contribution from the people has been generally successful in cases where people have been involved in the planning of the works through their own organisations like beneficiary committees, farmers unions, panchayats, etc.

## PROBLEMS OF MAINTENANCE OF MINOR IRRIGATION WORKS

9.40. *Cultivation of the Foreshore and Bed of Tanks.*—Cultivation of the foreshore and bed of tanks is a common practice in many areas in the south. The main difficulty in the way of stopping it relates to the eviction of the encroachers. In Andhra, there is a provision for the imposition, on cultivators encroaching on tank beds, of a penalty tax equal in amount to about 5 times the usual rate of land revenue in the area. But even such a high penalty tax does not seem to have acted as an effective disincentive.



9.41. *Silting and Decrease in Ayacut of Tanks.*—In Andhra Pradesh, silting had used up about 12% of the capacity of the tanks in the State, whereas for the group of districts having a level of irrigation lower than the total ayacut of the tanks, the corresponding figure was as high as 30 per cent. In Madras the percentage of reduction in capacity due to silting is estimated somewhere between 15 and 25 per cent and in Trivandrum district of Kerala, 47%. The rate of reduction in the capacity of tanks due to silting, as per data obtained from the State Government, works out to 3% and one per cent per year, respectively in Kerala and Madras. The ranges as reported for Srikukulam district of Andhra, Mysore and Rajasthan are : 1.3 to 2.0%, 0.2 to 1.0% and 0.3 to 0.4%, respectively.

9.42. *Restoration of Tanks.*—The average cost per acre of ayacut benefited from the restoration of tanks ranges from Rs. 48 in Rajasthan to Rs. 320 in Kerala. In Mysore, the average area benefited from restoration per tank comes to 30 acres and the average cost per acre to Rs. 164. While the rate of restoration proposed for the Third Plan period is the same in Madras and Mysore viz. 1,000 tanks per year, the number needing restoration in 1961 in Mysore was nearly two and a half times that in Madras. The restoration work seems to have made relatively good progress in Madras.

9.43. *Repair and Maintenance of Tanks.*—In Andhra and Madras, the 'circle' system is followed for attending to maintenance operations. In this system, the staffing pattern of irrigation supervisors is so arranged as to ensure inspection and repair work on each tank at least once in five to six years. This system, however, does not seem to be followed as a matter of policy and procedure in other States like West Bengal.

9.44. Instances of inadequacy of financial provision for maintenance have been reported from the field. This may very well arise because the budget provision in the past did not contain separate allocations on the construction of new minor irrigation works and on their maintenance, with the result that the latter often suffered more than the former. In West Bengal, however, there had been separate allocations (amounting to an annual provision of one and a half per cent of the original cost); but even here the allocation for maintenance has not been adequate.

9.45. *Silting of Wells.*—The problem of silting of wells is quite serious in some areas of Madhya Pradesh. A growing number of wells are falling into disuse, even though there is a shortage of irrigation facility. Shortage of funds and of labour as well as lack of initiative of the cultivators aggravate the problem. Blasting and boring operations are very often necessary; and use of the air-compressors is more effective. But in some blocks these machines and equipment are not available in sufficient number. Shortage of technical personnel also stands in the way.

9.46. *Equipment and Repairing Facilities.*—About 39% of the respondents in the sample had repairing facilities for pumping and other equipment within their villages; 22% had them at a distance between 1—5 miles; while the remaining 39% had to travel more than five miles for getting their equipment repaired. In none of the sample blocks, common facility workshops were found to exist. Only in a couple of blocks, mobile units were provided.

9.47. *Financial Assistance.*—Loan facilities made available to the cultivators have been relatively more for constructional purposes than for maintenance. Only 2% of the pucca wells in the sample got financial assistance.

for maintenance; and even for these it amounted to only 44% of the total cost. Thus, the overall financial aid for maintenance has been negligible. The figures for kutchha wells tell the same story in a still more pointed way. Only 0.6% of these received assistance for maintenance.

9.48. *Effect of Land Reforms on Maintenance.*—The ex-zamindari works have been neglected for long, and require a heavy initial outlay for renovation. In many areas, cultivators are not used to paying water rates for irrigation from these works. These factors make their maintenance not paying to the Government. As no separate accounts are maintained, it is not possible to know the exact amount of block funds spent on these works. It is, however, reported that the provision has generally fallen short of the requirements.

9.49. *Enforcement of Standards.*—Some of the field reports give ground for apprehending that the minimum standard of physical achievement in terms of rupees spent, are sometimes imposed in a stereotyped fashion. In West Bengal, the Tank Improvement Department could not get many of the projects sanctioned because the State Government previously examined the cost of the schemes against a fixed standard of Rs. 100 per acre of area benefited.

9.50. *Role of Beneficiary.*—The role of the beneficiary in respect of maintenance of minor irrigation works is not adequately realised by the people. One of the reasons for this state of affairs is that legislation in this respect is not pointed enough. But even where provisions exist, no serious attempt has been made to enforce them.

#### ADMINISTRATIVE AND ORGANISATIONAL PROBLEMS

9.51. *Machinery for Administrative Co-ordination.*—Separate Minor Irrigation Directorates have been created in the States of Orissa, Maharashtra and Bihar. But the new set up in Maharashtra as well as in Orissa shows some departure from the pattern recommended by the Annual Conference on Community Development, 1960, in as much as the Directorate is not under the Agricultural Department in any of these two States. In a number of States, co-ordination of minor irrigation programmes at the State level is being attempted through boards and working groups. At the district and block levels, there are regularly constituted co-ordination bodies. In some States, these are just departmental committees of officials, while in others non-officials are also represented on them.

9.52. *Lack of Co-ordination at the Field Level.*—Before the advent of the Community Development programme two wings of the State Governments, the Irrigation and the Agricultural Departments, were concerned largely with the programme of minor irrigation extension. The Revenue Department was also in the picture, but only for jobs connected with the maintenance of the works. When the Block administration came into the picture, one of the functions expected of it was the securing of the much needed co-ordination. But, the picture we have obtained from the sample blocks shows that the problems have yet to be fully solved. There are instances where information on the location of works being carried out by one agency is not even known to the other, with the result that two agencies operate in the same area with the possibility of overlapping. The problems become more acute at the lower level and nearer to the field. Sometimes

the power to make disbursements is not delegated to the agency which is responsible for on-the-spot execution of the works. This results in delay and friction. In some areas, the staff at the block level face difficulties in the efficient discharge of their duties and the allocation of their time, owing to the multiplicity of works to be executed and non-assignment of a definite order of priority among them.

9.53. The problems that generally arise in the case of the minor irrigation loans are undue delay in sanction and departmental rivalries in respect of power, authority and patronage. Sometimes, the list of loanees and the disbursement of the loans sanctioned in the block areas by other Governmental agencies is not made available to the Block administration. Sometimes, the maintenance of the works executed by the block does not receive adequate attention by the department concerned. Reports of such nature from the field suggest the need for greater attention being paid to the achievement of administrative co-ordination at different levels.

9.54. *Panchayats, Labour Cooperatives, and the Minor Irrigation Programme.*—There has been a general move in the direction of associating panchayats increasingly with the execution and maintenance of minor works. The actual situation in the field is not very encouraging. The panchayats in many areas are not yet in a position to take up such works because of paucity of funds. Their technical competence for such jobs is also doubted at times. The panchayats have operated in the past under serious handicaps created partly by the inadequacy of funds and partly by the lack of trained technical personnel. Both these limitations still remain to a considerable extent. Labour cooperatives were found to exist in the sample areas in two States. The record of their operations has not been satisfactory; and many of the works given to them could not be completed.

9.55. *Land Acquisition Problems.*—Difficulties and delays in the acquisition of land have been reported to have held up the progress of the minor irrigation programme in a number of States. The problem gets accentuated in many States because the difficulties of the departments operating the programme cannot be fully understood or given sufficient importance in the land acquisition proceedings which are handled by some other department. Difficulties in land acquisition have stood in the way of restoration of the zamindari tanks in Rajasthan by the State Government. Legal difficulties on the side of the Government and the lack of interest on the part of the cultivators to take up the cultivable lands within the command of the tanks, which are usually allotted temporarily for a period of five years only, have held up the extension of tank irrigation in parts of Rajasthan.

9.56. Among other factors, mention may be made of shortage of contractors with requisite technical skill, financial stability and willingness to take up works sited in remote areas. Sometimes, the practice of patronising the beneficiaries' committees has prejudiced local contractor against submitting tenders for any of the works.

#### STATE TUBE-WELLS

9.57. *Siting.*—The location and siting of the State tube-wells in the sample areas has, on the whole, been judicious and satisfactory, except in a few cases.

9.58. *Fixation of the Culturable Command Area.*—The C.C.A. for a State tube-well is taken as an area at least 50 to 60% larger than what it can irrigate. The area irrigated in 1959-60 was only 240 acres per well against a C.C.A. of 989 acres, in the sample areas of Ghazipur district, U.P., 373 acres against a C.C.A. of 938 acres in Saharanpur district U.P., and 340 acres against 863 acres in the sample areas in Punjab. The C.C.A. seems to have been fixed somewhat unrealistically. This state of affairs not only increases the cost of irrigation but also affects the interests of the cultivators adversely, since the Government policy is neither to give any loan nor even to allow other facilities like electric power for private tube-wells in the command area of the State tube-wells.

9.59. *Demand for Water for Foodgrain Crops.*—Before locating a tube-well in an area, the water requirements there in relation to the existing irrigation facilities are to be assessed. But, tube-wells are located in certain areas where sub soil water level is rising and the requirement for irrigation is not pressing because of seepage from canals. Further, in many parts, tube-wells have been used for irrigating cash crops like sugarcane etc., while the projects were undertaken under the GMP programme to raise the level of foodgrains production.

9.60. *Electric Power Supply.*—The rate per unit charged to the tube-wells is 2½ annas (16 nP.) for thermal power and 3½ pies (1.8 nP.) for hydel power in U.P., against 6.77 nP. in the Punjab and annas 3 (19 nP.) in Bihar. In U.P., a number of tube-wells have to be run on thermal power and some even on diesel power due to shortage of hydel power.

9.61. *Hours Worked per Year per Tube-well.*—The sample tube-wells in the Punjab worked in 1959-60 not more than 60% of the norm (about 3,750 hours per year) needed for its economic operation. In 1959-60, in U.P., the tube-wells of Saharanpur district, showed a higher level of performance (2,095 hours) than those of Ghazipur (1,686 hours). The average hours worked in both areas were lower than the norm of 2,300 hours needed for economic operation.

9.62. *Volume of Water Pumped out per Hour per Tube-well.*—In a good number of sample tube-wells, the volume of water pumped out per hour per tube-well has been found to be much lower than the expected figure of 33,000 gallons.

9.63. *Field Channels.*—In U.P. field channels are being lined by the Irrigation Department from one to two miles, depending on the size and conditions of the command area of a tube-well. The Government is also supposed to construct another two miles of kutchha channel. Many of the sample tube-wells had less than these lengths of field channel.

9.64. *Water Charges.*—Average rates paid by the cultivators for tube-well irrigation are much higher than canal water rates—six times for paddy and three times for fodder crops in the same area in Saharanpur, U.P.

9.65. *Administrative Difficulties.*—It has been observed in some areas of Ghazipur, U.P. that the Irrigation Department, on the other hand, and the Agriculture Department and the Block authorities, on the other, have somewhat different views about the factors behind the under-utilization of tube-wells. With the setting up of the Potential Assessment Committee at the

district level, it is hoped that the conflicting views would not stand in the way of a co-ordinated approach.

9.66. *Cooperative Tube-wells in U.P.*—In the view of knowledgeable farmers, ascertained through the consensus method, the cooperative tube-wells in Saharanpur district, U.P. have not been working satisfactorily. All the cooperative tube-wells in the sample areas in Saharanpur, U.P. are run on diesel power, which is one of the reasons for their high cost of operation. The U.P. Government have already taken over some of them. These observations, it should be repeated, relate only to the cooperative tube-wells in one district of U.P. and not to those in other parts of U.P. or other States like Gujarat.

9.67. *Records of Area Irrigated.*—While an adequate system exists for maintaining proper figures about areas irrigated from tube-wells, sometimes different departments have reported differently for the same item. Further, no distinction seems to be made between areas newly brought under irrigation by tube-wells and those that used to be irrigated previously but precariously by other sources and were subsequently covered by tube-wells.

#### SUGGESTIONS AND ISSUES FOR CONSIDERATION

9.68. The attempt in this study has primarily been to present an analytical picture of the difficulties that the minor irrigation programme has been facing at the field level. Problems at higher level have been brought in to the extent they are necessary and relevant. The discussion of the field problems and difficulties has often led to a consideration of the legislative position and administrative arrangements existing in different States. The inadequacies and shortcomings in these respects had to be referred to; and in this process of reference, some indirect suggestions have been implied. It is proposed to knit together some of these points in this section.

9.69. Minor irrigation is one of the more difficult programmes in the Five-Year Plans, at least as far as the agricultural sector is concerned. The nature of the sources and the type of works are not the same in different States. Even within the same State, the conditions and possibilities vary from one part to another. It is not, therefore, possible to generalise about the different aspects of either the administration of the minor irrigation programme or its extension or even about the role of the people or the beneficiaries. Besides, the nature and the development of minor irrigation administration have not been uniform or on the same line in different States. The local perspective is, therefore, very important in a consideration of the solution of the problems of minor irrigation. The points raised in this section are, therefore, in the nature of issues for further consideration and study.

9.70. *Survey of Minor Irrigation Possibilities and Prospects.*—One of the recommendations made in the report on the First Five Year Plan may very well bear a repetition now. The Planning Commission recommended at that time that "every State should carry out a systematic survey of the possibilities of undertaking such schemes, and formulate a programme of execution in an order of priority, so that their construction can be effected in a planned manner". This recommendation was, in fact, repeated in the report on the Second Plan. Some progress has, undoubtedly, been made in this direction; and a machinery created for the investigation of minor irrigation possibilities in some States, as for example, in Madras. By and large, however, it will be true to say that such a systematic survey has yet

to be either taken up or completed in most of the States. A survey of this type is probably more urgent now on the eve of the Third Plan than it was earlier. The reason we would like to re-emphasize this recommendation of the Planning Commission is that our survey data show that in some areas the scope for extension of minor irrigation is tending to become somewhat narrower, and/or more costly.

**9.71. Capacity of Minor Irrigation Facilities like Pump Sets and Tube-wells.**—One of the significant findings of this study is that there is a problem of under-utilization of the irrigation potential even in minor works. An important factor contributing to this under-utilization is the capacity of the works, particularly the privately owned ones like wells, in relation to the needs of the farmers. It has been pointed out in the report that there is a heavy incidence of under-utilization among pump sets (usually installed on wells) and private tube-wells. It has also been shown that the growth of pump sets has been phenomenally high, nearly three and one-third times during the last five years. The increasing use of pump sets will tend to add to the unutilized potential of wells particularly on scattered and fragmented holdings, unless the degree of utilization of their potential increases. In many areas, these pump sets are being purchased with loans from the block funds. There is usually a minimum capacity (5 H.P.) recommended for the pump sets on technical considerations. But in many cases, the actual irrigation needs require a smaller capacity of the pumps. In such situations, there is a tendency for over-capitalization and surplus irrigational capacity to develop on the farms. This also happens in the case of private tube-wells. All these suggest the need for co-relating, as far as possible, the capacity of the pump sets and tube-wells to the irrigational needs of the farmers and a more cautious approach to the sanctioning of loans.

**9.72. Cropping Pattern.**—In the case of Government owned works like bhandaras or big tanks, divergences between the official and the farmers' lines of thinking in the matter of cropping pattern often arise because of fundamental differences in approach. Generally speaking, financial return from the water charges is a weighty consideration with the Irrigation authorities. Cropping patterns are usually prescribed, within the range of possibilities offered by the seasonal availability of water, largely with this end in view. The cultivators, however, go by the relative economics of different crops and their assessment of costs and benefits over a period. While there is no easy solution to problems like this, the authorities concerned may probably go further to take into account the preferences of cultivators. If necessary, surveys may be conducted in an area to assess the views of the cultivators about the cropping pattern, the nature of loan facilities and equipment they need and the distribution of water they would like to have. In the light of such assessments, efforts may be made by the extension agencies to create and later, to augment the demand for water in the areas. One can go a step further and envisage more positive attempts to help the cultivators in farm and crop planning and in obtaining loans and other facilities so that they can make greater and better use of irrigation water.

**9.73. Water Rates.**—The problem of water rates has been baffling solution in many parts of the country. While it is not possible to generalise on this issue, one or two aspects may be raised here for further consideration. In the first place, water rates from sources like tanks are, in some States, not compulsory on the cultivators in the ayacut. Enforcement of water

rates in such areas, or at least a part of it, as a compulsory levy on the cultivators will help the State exchequer on the one hand and the utilization of irrigation potential by the farmers, on the other.

**9.74. People's Contribution.**—One of the anomalies in the minor irrigation programme is the insistence on people's contribution in the case of community or group works executed from the block funds and the non-requirement of any such contribution for projects under the Grow More Food programme. In some areas, this has led to a difficulty on the part of the Blocks in securing the requisite people's contribution for their works programmes which have suffered because the contribution was not forthcoming. The attempt in recent years has been to relax the rules so as to make the extent of such contribution very flexible. But on paper, it is still a necessary condition imposed on block programmes. Our view is that the various aspects and implications of the question have not been squarely faced since 1958. There are many issues involved in this dual approach and these need further examination at appropriate levels. We may note in passing that attempts to associate people's organisations like beneficiary committees, farmers' organisations and panchayats with the planning and execution of the minor works tend to evoke more of people's participation and contribution.

**9.75. Maintenance.**—Our study also reveals the unsatisfactory state of maintenance in a large proportion of the minor works. While our general impression is that arrangements for the supervision and maintenance of the minor irrigation works managed by the Government are improving in most States, there is a considerable scope for further progress in this field. It may be noted in this connection that the responses of the cultivators in our sample showed that the scope for increasing the supply of irrigation water from the minor sources was visualised by them much more in terms of repair, renovation and reconstruction of the existing works than of construction of new works. The broader issues that need further consideration and attention are briefly referred to in the following paragraphs.

**9.76. Foreshore Cultivation.**—Cultivation of the foreshore and bed of tanks is a serious problem affecting the life-time of the tanks, particularly in the southern States. Prevention or checking of such cultivation is recognised as a matter of some urgency. The major difficulty, however, relates to the eviction of the persons who have encroached and settled on such lands and/or to discouraging those who cultivate on a year-to-year basis through the levy of penal tax. In parts of Andhra, in spite of a provision for penal tax, the practice seems to persist, which goes to show the need for raising the penalty to a higher level.

**9.77. Periodicity of Maintenance.**—The periodicity of maintenance operations on tanks does not seem to have been scientifically fixed in many areas. A system like the circle system of maintenance as in Madras and Andhra may be considered for adoption by States where periodical maintenance is not yet a regular procedure. Care has, however, to be taken in such a system to ensure arrangements for timely detecting and promptly attending to the ravages of floods, cyclones, etc. as and when such things occur.

**9.78. Separate Allocation for Maintenance.**—State Governments may probably go farther in making adequate and specific allocation of funds for the maintenance of minor works in the budgets of the administering

departments. The practice of allocating funds as a proportion of the original cost of the works often results in inadequacy of funds because of the rise that has taken place in the level of costs and prices in the intervening years. For works undertaken by the Government, a maintenance levy may be imposed, if necessary on land irrigated from such works.

9.79. *Co-ordination.*—The existing arrangements for achieving administrative co-ordination in the field of execution, improvement, restoration and maintenance of minor irrigation works need to be reviewed fairly regularly by the State Governments in the light of the field situation as it develops. The aspects of the minor irrigation programme that probably need more attention, as far as co-ordination is concerned, are the technical preparation of schemes, their scrutiny and sanction, the technical and administrative control over staff, the fixing of the jurisdictions of different agencies in respect of supervision of the works and disbursement of funds. These raise issues of a complex nature that have been discussed in the appropriate sections of this report and deserve further study by the State Governments.

9.80. *Role of Beneficiaries.*—The role of beneficiaries and its enforcement through local institutions have not yet been clearly laid down through appropriate enactment in all States. The Planning Commission has been emphasizing the need for such legislation for a number of years. In fact, some of the State Governments have taken steps in this direction. It is hoped that other State Governments will move in this direction more expeditiously.

9.81. *Role of Panchayats.*—Another issue that needs serious attention is the role of the local institutions like panchayats and Panchayat Samitis. Our study shows that the panchayats have not yet been able to show a good record of work in the field of maintenance and extension of the minor irrigation programme, at least that part of it that has been entrusted to them. The disabilities that they suffer from are inadequacy of funds and shortage of trained personnel. How these handicaps are to be removed and the panchayats helped more concretely in the discharge of their functions is a matter that deserves special attention. The Panchayat Samitis, new bodies as these are, need special help and support, so that they can function efficiently in those fields.

9.82. *Sanctioning of Loans.*—There is a considerable scope for streamlining the process of sanction and grant of loans and other financial assistance to the beneficiaries. Delays and procedural bottlenecks are still reported by the cultivators in many areas. There is also a scope for giving further help to the cultivators in the matter of extending minor irrigation by making available to them machines and equipment like air-compressors and boring machines. Improvement in the servicing and supply of spare parts of tube-wells and pump sets is also a problem that needs to be looked into in certain areas.

#### STATE TUBE-WELLS

9.83. *Fixation of the C.C.A.*—The problems of State tube-wells need special consideration and fuller study. Among the issues thrown up by our study, the fixation of the culturable command area is one of the more important ones. A new approach seems to be called for in regard to the C.C.A. of the tube-wells. The disparity between the maximum irrigable capacity of a tube-well and the size of the command areas as fixed at present tends to cause undue hardship to some of the cultivators in that area, as has been



pointed out in the report. The problem may be solved if an attempt is made to include within the command area of a tube-well an area of which at least 80% can be actually irrigated by it.

9.84. *Water Charges.*—The disparity in the same area between the cost of irrigation from tube-wells and that from canals needs to be given a serious consideration. What is needed is to bring the two as much in line as possible. One way of tackling the problem is to go for a two-part tariff for the tube-well water. A fixed amount may be imposed as a levy on all the cultivators within the command (to be refixed as suggested in the last paragraph) of a tube-well; and a surcharge realised on the basis of the volume of water sold. The surcharge will naturally be lower than the present rate and will probably induce the cultivators to make greater use of tube-well water. The levy will also be a pressure on all the cultivators in the command to use tube-well water. Another suggestion that may be considered in this connection is the use of differential rates for irrigation during the day time and at night. Irrigation at night may be made cheaper if electricity is supplied to the tube-wells at a concessional rate at night when normally the overall demand for electric power is comparatively low. Such a system is expected to give some incentive to the cultivators and may prove financially helpful to both the Irrigation and the Electricity Departments. The enforcement of such a system should not, however, be left entirely in the hands of the tube-well operators. Local committees and panchayats should be associated with the management of the tube-wells as much as possible.

9.85. *Field Channels.*—Field channels pose a number of problems not only to the tube-well authorities but also to the cultivators. The length of the channels to be constructed by the Government, the portion to be lined by them, the maintenance of the field channels and the acquisition of land are issues which do not admit of easy and simple solutions. In the first place, it is not realistic to expect the Government to construct pucca field channels beyond a certain minimum length if economy in operation is going to be a consideration with them. Of course, if the command area of a tube-well is suitably reduced, the length of the channel may also be proportionately shortened. The immediate complaints in many areas, however, relate largely to the system of supervision and maintenance of the field channels. Quite often breaches occur because of inadvertence on the part of cultivators and these are not sometimes reported in time. There is a need, on the one hand, for better public relations between the cultivators and the tube-well authorities, and, on the other, for effective cooperation and sharing of responsibility between these two sides. Panchayats and local committees can indeed play an important role in straightening out such matters.

9.86. *Land Acquisition.*—Land acquisition for the construction of field channels is a separate matter, in which the irrigation authorities have generally been at a disadvantage. The ideal arrangement will be to have the acquisition of land for the field channels completed before the energizing of the tube-wells. Unfortunately, this may not be possible because of legal complications and delays in the disposal of acquisition proceedings. How such problems can be solved and delays avoided, and what delegation of power, if any, can be affected are matters for consideration by the State Governments.

9.87. There are many other problems associated with the administration and extension of the minor irrigation programme on which we have not tried to raise any issues in his section. For example, it was noted in the course

of this study that the State Governments do not seem to collect enough data either for the purpose of estimating the net increase in the irrigable (after taking into account depreciation) area of the minor works in each year or even about the gross irrigable area of the works by season. Besides, records of areas that are newly brought under irrigation and those which were covered previously but precariously by other sources are not maintained separately. Finally, even the village records do not seem to reflect accurately the extent of irrigation and probably its increase. The need for improvement of the irrigation statistics in the country is generally recognized. This study emphasizes it further, just as it re-stresses the desirability of action in many other directions. All these points deserve further and fuller consideration. Our purpose in this section has been to raise some important issues on the basis of the findings of a survey conducted in a sample selected from 21 districts in 14 States.



## APPENDIX A

### *Definition of Pucca and Kutcha Wells in the Districts of Ghazipur and Azamgarh in Eastern U.P.*

The definitions of pucca and kutcha wells in the districts of Ghazipur and Azamgarh in the Eastern U.P. are given below :—

#### 1. *Pucca Well*

A well which is provided with a curb (locally called 'jumwat' or 'nichak'), usually made of wood, at the bottom, masonry ring (called pucca gola) sunk till the stratum on which the well rests and masonry steining starting from the bottom may be called a pucca well.

The average life of such a well is expected to be about 100 years. The average cost of construction is estimated at about Rs. 1,500, depending on the depth to which the pucca gola is sunk.

A pucca well is estimated to irrigate 5 acres of land, and an additional 5 acres after deep boring, and again after installation of persian wheel on deeply bored well, another additional 5 acres. Thus a pucca well after deep boring and installation of persian wheel is expected to irrigate 15 acres. The district planning authorities, however, are reported to have revised these estimates for future planning and have assumed an additional area of 3 acres after deep boring and another 4 acres after the installation of persian wheel.

#### 2. *Kutcha Well*

The essential difference between pucca and kutcha well is that a pucca well is provided with the curb, pucca gola is sunk till the stratum on which the well rests and the masonry steining extends from the bottom of the well to its top, while in a kutcha well the steining is not for full depth of the well. Kutcha wells may be of several types, depending on the nature of steining, etc.;

(i) If a well is completed without sinking any pucca gola, without a curb and without any deep boring, but with masonry steining from about three-fourth of the water level to the ground level, it is called a kutcha well. Such wells may be constructed only in those areas where hard soil is easily available to serve as foundation.

The average life of such a well is about 25 years; though in some cases the well may last even more than 50 years. Its average cost comes to about Rs. 600 to Rs. 800 depending on the availability of hard soil and the height of steining. (Perhaps this type may sometimes be confused as pucca and such wells may have been classified as pucca in a few areas).

(ii) The second type of kutcha well is dug up to subsoil water, without any 'nichak' or masonry work. The average life of such a well is about 2 years, if the soil is hard and only a season if it is sandy. This type is called 'Chaura' or 'Khankhur'.

(iii) Sometimes after digging a kutcha well of type (ii) a fence like thing, locally called 'baira' or 'raitha' made of arhar or bamboo sticks is provided inside the well up to the height of water level. This protects the well against sand and gives it a little more life. The total cost of such a well comes to about Rs. 15 to Rs. 20 inclusive of imputed value of labour. On an average, this type of well does not irrigate more than 1 to 1½ acres. These wells are usually demolished every year and constructed anew next year.

(iv) The kutcha well of type (ii) may be fitted with a rectangular wooden curb supported by wooden pillars. No gola is sunk but masonry work is provided resting on the curb. These are locally called 'Kath Kuian'. Its cost is about Rs. 300 and irrigable area is about 1 to 2 acres. Such wells usually last for 20 to 25 years.

(v) If instead of masonry work, rectangular steining of wooden planks is provided, the well may last for 15 to 20 years and the corresponding cost is about Rs. 200 to Rs. 300, depending on the height of steining.

(vi) A kutchha well may be provided with a full steining of bamboo or arhar sticks till the ground level. This type lasts for 2 to 3 years. The cost of construction is Rs. 40 to Rs. 50 including the value of material and labour, both of which are usually freely obtained.



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## APPENDIX—B

**Statement Showing Administrative Agencies Responsible for Handling Minor Irrigation Schemes of Different Types along with Arrangements Made for Co-ordination in Different States**

State (1)	Departments handling minor irrigation schemes (2)	Nature of works/schemes handled (3)	Organisational arrangements for co-ordination (4)	Other remarks (5)
1. Andhra Pradesh	(i) Revenue	The department is responsible for minor irrigation programmes, for incurring expenditure, and reviewing progress of the works; attends to all the works with ayacut less than 100 acres in Telangana and 200 acres in Andhra.		The Collector was in charge of minor irrigation programme at the district level upto April, 1961. He was assisted by minor irrigation establishment, comprising of minor irrigation overseers and supervisors. Thereafter the maintenance of all minor irrigation sources, under the control of Revenue Department, have been transferred to Panchayat Samitis in the block areas and to Zilla Parishads outside Panchayat Samiti blocks with exception of tanks fed from P.W.D. sources or works which the Collector considers desirable to be transferred to P.W.D. for specific reasons e.g. if a common source feeds more than one tank. This procedure shall apply also to restoration, renovation or improvements to minor irrigation tanks under the control of Revenue Department for which funds are available under the Second Five Year Plan or the Third Five Year Plan.

APPENDIX B—*contd.*

(1)	(2)	(3)	(4)	(5)
<i>Andhra Pradesh</i> ( <i>contd.</i> )	(ii) P.W.D.	Attends to works irrigating 100 acres and above in Telangana and 200 acres and above in Andhra.		
2. <i>Assam</i>	(i) Agriculture	Execution of small schemes costing up to Rs. 10,000 through beneficiaries. (ii) Execution of power pump irrigation scheme. (iii) Maintenance of pump sets, and (iv) Distribution of diesel pump sets for lift irrigation.	Co-ordination between the different departments has not been a serious problem in the State. Sometimes, however, there have been cases of overlapping.	All M.I. schemes Assam are executed by the beneficiaries themselves under the supervision of the departmental staff. In the block areas, the block staff under Department of Agriculture and the VLWs are responsible for the execution of these schemes whereas the agriculture inspectors execute the schemes in the non-block areas. Over all supervision in both cases is of D.A.O.
	(ii) Embankment and Drainage Division P.W.D.	Schemes of the nature of embankments, bunds and drainage channels, costing over Rs. 10,000 for the purpose of protection of areas from the floods and also for providing drainage facilities to the water-logged areas.	No development committee or working group on utilization has been formed at any level of the State.	Minor irrigation programme in Assam is essentially an integrated programme of flood control, drainage and irrigation.

## 3. Bihar

- (i) Agriculture Department (Addl. Director Engg.).

Till 1959-60 minor irrigation was under taken by Revenue, Agriculture and Irrigation Departments, but recently, a full-fledged wing with engineering personnel has been created under Agriculture Department to deal with all minor irrigation schemes.

- (ii) Irrigation

Irrigation Department undertakes only such minor works as are directly related to major projects.



At the State level, there is a State Co-ordination Committee presided over by the Development Commissioner. Similar committees, presided over by the Divisional Commissioner, DM and SDO respectively, are also there at the Divisional, District and Sub-divisional levels. At the block level, there is also a B. D. C. presided over by some non-official. Representatives of various development departments as well as of the Irrigation Department are included in the committees.

There is also a State Working Group whose members are from Irrigation, Industries, Cooperatives, Animal Husbandry, Agriculture and Revenue Departments. It meets twice a year and is presided over by the Development Commissioner. Chief Engineer (Irrigation) is the convener of the meetings.

The planning of minor irrigation programme at the State level is co-ordinated through the State Development Board consisting of a sub committee of the Chief Engineer and representatives of the Departments of Agriculture, C.D., etc.

## 4. Gujarat

- (i) P.W.D.

- (a) Artesian, wells and tube-wells, surface irrigation. (b) Protection works, maintenance of works, irrigating over 250 acres.

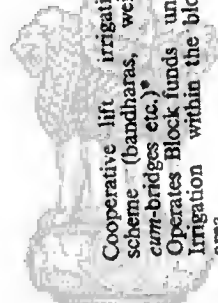
## APPENDIX B—contd.

(1)	(2)	(3)	(4)	(5)
Gujarat (contd.)	(ii) C.D.	Maintenance of works up to 250 acres ayacut in block areas.	Co-ordination at the district level is done by the District Co-ordination Committee presided over by the Collector.	
	(iii) Revenue	Maintenance of works up to 250 acres ayacut in non-block areas.		
	(iv) Agriculture	Construction and repair of wells, installation of pump sets etc.		
	P.W.D.	Since 1958 all the minor irrigation works are under its control, both for construction and restoration. Before this Irrigation and Revenue Departments were taking care of minor irrigation works with an ayacut of more than 200 acres and below 200 acres respectively. Maintenance of works with ayacut above 5 acres in Travancore Cochin area and 200 acres or more in Malabar.	At the district level, the District Development Council, presided over by the Collector, is in charge of reviewing the position of all minor irrigation sources in the district. The Council includes officials of the Revenue Department and Irrigation Department, besides the nominated non-official members.	
5. Kerala	(i) Revenue	Attends to all minor irrigation works having ayacut of less than 200 acres.		
	(ii) P.W.D.	Attends to all minor irrigation works having more than 200 acres of ayacut.		
	(iii) Food Production Department (under Revenue Department)	Maintains tanks in erstwhile zamindari areas and transfers them after repair to P.W.D. or Revenue Department.		
6. Madras	(i) Revenue	Attends to all minor irrigation works having ayacut of less than 200 acres.	The progress of both expenditure and physical achievement are reviewed by the District Collector every month; copies of their reviews are submitted to the Board of Revenue which consolidates them and prepares a review for the State as a whole and submits it to the Government.	
	(ii) P.W.D.	Attends to all minor irrigation works having more than 200 acres of ayacut.		



Madras (contd.)	(iv) Desilting-cum-Reclamation Division-special P.W.D. Division	Restoration and maintenance of a vast number of tanks particularly the ex-Zamindari tanks.	At the district level, an Irrigation Conference is held every six months where all the works are reviewed by all officers and non-officials concerned with the maintenance and repair of minor irrigation works.
7. M.P.	(i) Irrigation Branch of P.W.D.	Carries out works costing up to Rs. 10 lakh from the funds made available by the Agriculture Ministry.	There are Committees at different levels which bring about effective co-ordination. Such Development Committees have on them representatives of different departments. Co-ordination in the State has been adequate.
	(ii) Revenue	The District Collectors are allotted a sum of Rs. 50,000 every year and the execution of works by this fund is done by the Revenue Department with or without the finance of the Irrigation Department.	
	(iii) Agriculture	The Department grants Taccavi loans direct to the cultivators for wells, pumps etc.	
	(iv) C.D.	This agency is responsible for carrying out all M.I. works (like wells, pumps, rahats etc. by giving Taccavi loans to the individual cultivators) in C.D. areas.	
	(v) Panchayat	Maintenance of works constructed by blocks on grant-in-aid basis.	
8. Maharashtra	(i) Agriculture	(a) Construction of small irrigation tanks and repair of old tanks irrigating less than 250 acres (in Vidharbha region only). (b) Financial assistance in the shape of loans. (c) Providing service of air compressor and blasting and boring machines at	The planning, execution and the design of minor irrigation works irrigating above 250 acres have been entrusted to a separate Director of M.I. under the Irrigation and Power Department. At the State level, there is also a Water Utilization Committee. For the investigation of the minor irrigation schemes, special staff has been appointed at the rate of 4 to 6 overseers per district.

APPENDIX B—*contd.*

(1) <i>Maharashtra (contd.)</i>	(2) <i>(i) Agriculture (Contd.)</i>	(3) <i>concessional rates, (d) Deals with wells including pump sets.</i>	(4) <i>consisting of heads of the Departments like P.W.D., Irrigation, Agriculture, Cooperative, C.D. etc. The Committee also has a standing committee to review the problems of all irrigation works. The planning of M.L. programmes is co-ordinated through this committee and the State Development Board (in which the ministers and secretaries of the several departments participate). In certain districts where the work load justifies, separate sub-division for the construction of minor irrigation works has been sanctioned. At the divisional level the Superintending Engineer P.W.D. is the controlling and co-ordinating officer. At the district level the irrigation problems are discussed at the meetings of the District Development Boards Sub-committee on Irrigation and a list of minor works to be executed in the district, having regard to the priority, depending upon the needs of area, cost of the scheme etc., is prepared. At the divisional level as well as the State level this priority is further revised in view of overall priority of the Government.</i>	(5)
	(ii) Cooperative	 <p>Cooperative lift irrigation scheme (bandharas, weirs, cum-bridges etc.) Operates Block funds under Irrigation within the block area. Construction and maintenance of minor irrigation works, including bandharas, irrigating below 250 acres.</p>	<p>The execution, supervision and maintenance of these schemes is done through the Coop. Departmental officers both at the divisional and district level.</p>	
	(iii) C.D.			
	(iv) Revenue			
(v) Irrigation and Power (functioning through Directors of M.L.).				

9. Mysore

(i) C.D.



Execution of works costing less than Rs. 2,500 in C.D. areas.

(ii) P.W.D.

(a) Execution of works costing more than Rs. 2,500. (b) Maintenance and restoration of minor works. Sinking of irrigation wells, supply of electric and diesel oil engines, pump sets and the other GMF irrigation schemes.

(iii) Agriculture/Revenue

(i) At the State level, there is a Chief Engineer in charge of minor irrigation who also looks after public health engineering activities.

(ii) At the District level, co-ordination between the P.W.D., Revenue, Agriculture and C.D. Departments is brought about through the monthly meetings of the District Co-ordination Committee.

District Co-ordination Committee consisting of the District Agriculture Officer, Executive Engineer, Assistant Registrar of cooperative and the Superintending Agricultural Officer with the Collector as the Chairman, have also been formed in those districts where there are more than 10 lift irrigation societies. Such committees go into the difficulties of these societies and suggest ways and means of overcoming them.

10. Orissa

(i) C.D.

Undertakes all M.I. schemes other than lift irrigation, and bigger storage schemes in the block areas.

(ii) Revenue

Undertakes the above works in non-block areas.

(iii) Agriculture

Handles only lift irrigation schemes e.g. tube-wells.

A master plan for each of the blocks in Orissa is prepared on the basis of the preliminary survey done by the block overseer. The projects

APPENDIX B—*contd.*

Bigger schemes of diversion weirs, bunds and other storage schemes.

Orissa (contd.)

(iv) Irrigation

technical staff for the supervision and maintenance of different projects is formulated. Under the scheme, two districts generally have one Executive Engineer under whom there are Assistant Engineers and Overseers. The administrative control of the Executive Engineer who is stationed at the divisional headquarters is with the Commissioner. The control of an Executive Engineer, who is stationed at the district headquarters, is with the Collector.



so listed are then inspected by the Assistant Engineer or the Executive Engineer and then a final list is drawn up which is placed before the Block Advisory Committee for fixing priority order of projects. An investigation programme is drawn up by the Deputy Development Commissioner in consultation with the concerned engineers for smaller works. The investigation of bigger projects is done by the investigation team attached to the Revenue Divisional Commissioners and to the Deputy Development Commissioner. Following is the arrangement of investigation of projects.

11. Punjab

(i) Irrigation

(1) Maintenance of tube-wells under TCM and GMP schemes.

(2) Maintenance of bunds and tanks in Gurgaon, Mohinderghar, Ambala and Kangra District.

(3) Lift irrigation by pumps in hilly areas (proposed).

Administration of loans, subsidies etc. for percolation wells, pump sets and private tube-wells.

(ii) Agriculture

(iii) C.D.

*Projects—Costing less than Rs. 50,000. Investigated by—Block Overseer or Revenue Officer under the guidance of Assistant Engineer.*

*Project—Costing more than Rs. 50,000.*

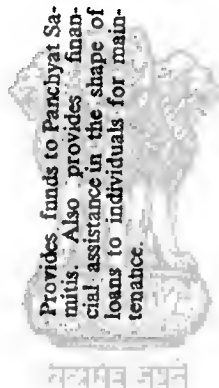
*Investigated by—Investigation Teams attached to the Revenue Divisional Commissioner and to the Deputy Development Commissioner.*

At the state level a Minor Irrigation Board, set up in June 1960, co-ordinates the scheme and policies of Agriculture and Irrigation Department in respect of minor irrigation works. There is no such agency at the lower levels. The Government is considering the appointment of an officer of the status of Superintending Engineer in the Agriculture Department to take up all M.I. works in the State.

In Punjab there also is a subcommittee of the working group for irrigation and agriculture production.



APPENDIX B—*contd.*

(1)	(2)	(3)	(4)	(5)
12.	<i>Rajasthan</i>	(i) Irrigation	Gives funds, for the State-owned M.I. works, to the concerned authorities for construction and maintenance of works irrigating more than 50 acres.	At the State level, a co-ordination committee on M.I. works has been set up with the Development Commissioner as Chairman. The Committee having secretaries of Agriculture, Irrigation, Planning, Finance and other Development Departments as its members, discusses allotment of funds and other co-ordination problems.
		(ii) Agriculture	Provides funds to Panchayat Samitis. Also provides financial assistance in the shape of loans to individuals for maintenance.	At the divisional level, the problems of co-ordination are attended to by the Divisional Commissioners.
				At the district level, the District Development Officer, who is also Collector-cum-District Magistrate, is responsible to achieve co-ordination. At the Panchayat Samiti level all funds for minor works are routed through the Samitis. Maintenance of works irrigating 50 acres or less is the responsibility of the panchayat.
13.	<i>U.P.</i>	(i) Irrigation	Handles all the State M.I. works.	There is a State level campaign co-ordination committee consisting of Heads of Departments and presided over by the Chief Minister. At the divisional level, there is a Divisional Planning Committee. At the district level,
		(ii) Agriculture	Gives loans and subsidies to cultivators to construct tube-wells.	
		(iii) Planning	Assists in creation of minor irrigation potential in block areas with the help of people's participation.	

14. West Bengal

(i) Agriculture

Execution of works costing up to Rs. 10,000 such as :  
 (i) Lift irrigation schemes with small sized pump sets costing Rs. 2,500;  
 (ii) Small diversion weirs;  
 (iii) Water retention bunds;  
 (iv) Deep tube-well irrigation schemes.

(ii) Tank Improvement (part of Agriculture Department).

Handles improvement of old and derelict tanks under the Tank Improvement Act of 1939 amended in November 1948.

(i) Irrigation

Works costing more than Rs 10,000 and up to Rs. 10 lakh such as embankments, diversion weirs, bunds etc. together with the required length of canals and distributaries are handled by this Department.

there is also the District Planning Committee with Irrigation Subcommittee. Further down, there are Block Committees, and Village Action Committees which also give thought to the problem under discussion. The State Irrigation Department is being made responsible for preparing and placing before the State Co-ordination Committee complete information regarding the programme and progress of utilization.

There is no committee or working group at the State level which is responsible for looking to the utilization or other matters pertaining to M.I. schemes.

# APPENDIX C

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TABLE C—1

*List of Blocks Selected for the Study of Minor Irrigation*

State	Source of minor irrigation studied	District selected	Block selected	Year of inception of the block (April to March)
(1)	(2)	(3)	(4)	(5)
Andhra Pradesh	.. Tanks	Srikakulam	Palakonda	1956-57
	Tanks	Warangal	Kotabommali	1957-58
			Sangam	1957-58
			Parkal	1957-58
Assam .. ..	.. Pump sets	Nowgong	Kapili	1956-57
			Mayong	1956-57
Bihar .. ..	.. Wells	Saran	Sonepur	1956-57
	Wells,	Shahabad	Hathwa	1957-58
	Ahars & Pynes		Shahpur	1956-57
			Sheosagar	1952-53
Gujarat .. ..	.. Tanks & Wells	Sabarkanta	Modasa	1952-53
			Bhiloda	1956-57
Kerala .. ..	.. Tanks & Wells	Trivandrum	Chirayankil	1956-57
			Kazhakuttam	1955-56
Madhya Pradesh	.. Tanks	Raipur	Phllari	1954-55
	Wells	Chattarpur	Kaudia	1953-54
	Wells	Dhar	Rajnagar	1955-56
			Laundi	1958-59
			Kukshi	1955-56
			Badnawar	1955-56
Madras .. ..	.. Tanks	Ramnad	Rajapalayam	1954-55
			Kamuthy	1956-57
Maharashtra	.. Wells	West Khandesh	Sahada	1956-57
			Sakri	1955-56
Mysore .. ..	.. Tanks & Wells	Kolar	Sidhalaghatta	1953-54
			Chintamani	1956-57
Orissa .. ..	.. Tanks & Reservoirs	Dhankenal	Talcher	1955-56
			Attmallik	1956-57
Punjab .. ..	.. Tube-wells & Percolation Wells	Patiala	Doraha	1952-53
			Rajpura	1953-54
Rajasthan .. ..	.. Wells	Pali	Sumerpur	1952-53
	Tanks & Wells	Sawai	Sojat	1957-58
		Madhopur	Sawai Madhopur	1954-55
			Mahawa	1953-54
Uttar Pradesh	.. Tube-wells & Wells	Saharanpur	Deoband	1953-54
	Tube-wells & Wells	Ghazipur	Nagal	1956-57
			Mardah	1952-53
			Deokali	1954-55
West Bengal .. ..	.. Bunds & Reservoirs	Midnapur	Chandrakona	1957-58
	Small Irrigation Works	Jalpaiguri	Tamluk	1955-56
			Kumargram	1956-57
			Falakata	1957-58

TABLE C—2  
Distribution of Tanks, Pucca and Kutcha Wells by Ownership Type—State-wise

Sample areas in States	Tanks						Pucca Wells						Kutcha Wells			
	Total Type of ownership (% to Col. 2)			Total no. in the sample			Type of ownership (% to Col. 7)			Total no. in the sample			Type of ownership (% to Col. 12)			
	no. in sample	Govern-ment	Pan-chayat	Private-indivi-dual	Private-joint	Private-indivi-dual	Govern-ment	Pan-chayat	Private-indivi-dual	Private-joint	Private-indivi-dual	Govern-ment	Pan-chayat	Private-indivi-dual	Private-joint	Private-indivi-dual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Andhra	93	93.5	6.5	0.0	0.0	62	0.0	0.0	61.3	38.7	1087	0.0	0.0	81.6	18.4	
Pradesh	17	35.3	5.9	58.8	0.0	147	2.0	2.0	96.0	0.0	3	0.0	0.0	100.0	0.0	
Bihar	1	100.0	0.0	0.0	0.0	105	0.0	0.0	48.6	51.4	39	0.0	0.0	48.7	51.3	
Gujarat	19	26.3	5.3	57.9	10.5	26	0.0	0.0	100.0	0.0	7	0.0	0.0	100.0	0.0	
Kerala	11	72.7	0.0	0.0	27.3	201	2.0	0.0	52.2	45.8	266	19.9	0.0	60.2	19.9	
Madhya Pradesh	21	95.2	4.8	0.0	0.0	252	0.0	0.0	56.7	43.3	112	0.0	0.0	100.0	0.0	
Madras	0	—	—	—	—	51	5.9	1.9	66.7	25.5	12	0.0	0.0	50.0	50.0	
Maharashtra	5	100.0	0.0	0.0	0.0	85	0.0	0.0	88.2	11.8	124	0.0	0.0	94.4	5.6	
Mysore	10	40.0	30.0	10.0	20.0	7	0.0	0.0	100.0	0.0	166	0.0	0.0	97.6	2.4	
Orissa	0	—	—	—	—	289	0.0	0.0	32.9	67.1	0	—	—	—	—	
Punjab	1	0.0	100.0	0.0	0.0	270	0.0	0.0	11.1	88.9	37	0.0	0.0	0.0	100.0	
Rajasthan	22	0.0	90.9	9.1	0.0	134	0.0	0.0	76.9	23.1	2	0.0	0.0	100.0	0.0	
Uttar Pradesh	57	17.5	0.0	10.6	71.9	15	0.0	0.0	100.0	0.0	28	0.0	0.0	100.0	0.0	
West Bengal	257	56.8	12.8	11.7	18.7	1644	0.6	0.2	52.5	46.7	1883	2.8	0.0	79.8	17.4	
All States sample																

1 Includes 16 Inamdari tanks ownership of which is in dispute between the Government and the owners.

2 Includes 1 tank owned by a temple

TABLE C—3  
Distribution of Tanks by Ownership Type and Use Position—State-wise

Sample areas in States	Government			Panchayat			Private—individual			Private—joint			Total		
	In use	Out of use	Total	In use	Out of use	Total	In use	Out of use	Total	In use	Out of use	Total	In use	Out of use	Total
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1)															
Andhra Pradesh	78 (89.6)	9 (10.4)	87 (100.0)	5 (83.3)	1 (16.7)	6 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	83 (89.2)	10 (10.8)	93 (100.0)
Bihar	5 (83.3)	1 (16.7)	6 (100.0)	1 (100.0)	0 (0.0)	1 (100.0)	10 (100.0)	0 (0.0)	10 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	16 (94.1)	1 (5.9)	17 (100.0)
Gujarat	1 (100.0)	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0)	0 (0.0)	1 (100.0)
Kerala	5 (100.0)	0 (0.0)	5 (100.0)	1* (100.0)	0 (0.0)	1 (100.0)	11 (100.0)	0 (0.0)	11 (100.0)	2 (100.0)	0 (0.0)	2 (100.0)	19 (100.0)	0 (0.0)	19 (100.0)
Madhya Pradesh	7 (87.5)	1 (12.5)	8 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (100.0)	0 (0.0)	3 (100.0)	10 (90.9)	1 (9.1)	11 (100.0)
Madras	20 (100.0)	0 (0.0)	20 (100.0)	1 (100.0)	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	21 (100.0)	0 (0.0)	21 (100.0)
Mysore	5 (100.0)	0 (0.0)	5 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	5 (100.0)	0 (0.0)	5 (100.0)
Orissa	4 (100.0)	0 (0.0)	4 (100.0)	3 (100.0)	0 (0.0)	3 (100.0)	1 (100.0)	0 (0.0)	1 (100.0)	2 (100.0)	0 (0.0)	2 (100.0)	10 (100.0)	0 (0.0)	10 (100.0)
Rajasthan	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0)	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0)	0 (0.0)	1 (100.0)
Uttar Pradesh	0 (0.0)	0 (0.0)	0 (0.0)	20 (100.0)	0 (0.0)	20 (100.0)	2 (100.0)	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	22 (100.0)	0 (0.0)	22 (100.0)
West Bengal	10 (100.0)	0 (0.0)	10 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	6 (100.0)	0 (0.0)	6 (100.0)	41 (100.0)	0 (0.0)	41 (100.0)	57 (100.0)	0 (0.0)	57 (100.0)
All States sample	135 (92.5)	11 (7.5)	146 (100.0)	32 (97.0)	1 (3.0)	33 (100.0)	30 (100.0)	0 (0.0)	30 (100.0)	48 (100.0)	0 (0.0)	48 (100.0)	245 (95.3)	12 (4.7)	257 (100.0)

\*Owned by a temple.

TABLE C-4  
Distribution of Pucca Wells by Ownership Type and Use Position—State-wise

Sample areas in States	Government			Panchayat			Private-individual			Private-joint			Total		
	In use	Out of use	Total	In use	Out of use	Total	In use	Out of use	Total	In use	Out of use	Total	In use	Out of use	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Andhra Pradesh	..	0	0	0	0	0	37 (97.4)	1 (2.6)	38 (100.0)	23 (95.8)	1 (4.2)	24 (100.0)	60 (96.8)	2 (3.2)	62 (100.0)
Bihar	..	3 (100.0)	0	3 (100.0)	3 (100.0)	0	133 (94.3)	8 (5.7)	141 (100.0)	0	0	0	139 (94.6)	2 (5.4)	141 (100.0)
Gujarat	..	0	0	0	0	0	50 (98.0)	1 (2.0)	51 (100.0)	54 (100.0)	0	54 (100.0)	104 (99.0)	1 (1.0)	105 (100.0)
Kerala	..	0	0	0	0	0	26 (100.0)	0	26 (100.0)	0	0	0	26 (100.0)	0	26 (100.0)
Madhya Pradesh	..	4 (100.0)	0	4 (100.0)	0	0	102 (97.1)	3 (2.9)	105 (100.0)	80 (87.0)	12 (13.0)	92 (100.0)	186 (92.5)	15 (7.5)	201 (100.0)
Madras	..	0	0	0	0	0	143 (100.0)	0	143 (100.0)	109 (100.0)	0	109 (100.0)	252 (100.0)	0	252 (100.0)
Maharashtra	..	0 (0.0)	3 (100.0)	3 (100.0)	1 (100.0)	0 (0.0)	15 (44.1)	19 (55.9)	34 (100.0)	11 (84.6)	2 (15.4)	13 (100.0)	27 (52.9)	24 (47.1)	51 (100.0)
Mysore	..	0	0	0	0	0	72 (96.0)	3 (4.0)	75 (100.0)	9 (90.0)	1 (10.0)	10 (100.0)	81 (95.3)	4 (4.7)	85 (100.0)
Orissa	..	0	0	0	0	0	7 (100.0)	0	7 (100.0)	0	0	0	7 (100.0)	0	7 (100.0)
Punjab	..	0	0	0	0	0	95 (100.0)	0	95 (100.0)	157 (80.9)	37 (19.1)	194 (100.0)	252 (87.2)	37 (12.8)	289 (100.0)
Rajasthan	..	0	0	0	0	0	28 (93.3)	2 (6.7)	30 (100.0)	214 (89.2)	26 (10.8)	240 (100.0)	242 (89.6)	28 (10.4)	270 (100.0)
Uttar Pradesh	..	0	0	0	0	0	97 (94.2)	6 (5.8)	103 (100.0)	30 (96.8)	1 (3.2)	31 (100.0)	127 (94.8)	7 (5.2)	134 (100.0)
West Bengal	..	0	0	0	0	0	15 (100.0)	0	15 (100.0)	0	0	0	15 (100.0)	0	15 (100.0)
All States sample	..	7 (70.0)	3 (30.0)	10 (100.0)	4 (100.0)	0 (0.0)	820 (95.0)	43 (5.0)	863 (100.0)	687 (89.6)	80 (10.4)	767 (100.0)	1518 (92.3)	126 (7.7)	1644 (100.0)

TABLE C-5  
Distribution of Kutch Wells by Ownership Type and Use Position—State-wise

Sample areas in States	Government			Private—individual			Private—joint			Total		
	In use	Out of use	Total	In use	Out of use	Total	In use	Out of use	Total	In use	Out of use	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Andhra Pradesh	0	0	0	737 (83.1)	150 (16.9)	887 (100.0)	173 (86.5)	27 (13.5)	200 (100.0)	910 (83.7)	177 (16.3)	1087 (100.0)
Bihar	0	0	0	0	0	0	0	0	0	0	0	0
Gujarat	0	0	0	0	0	0	0	0	0	0	0	0
Kerala	0	0	0	0	0	0	0	0	0	0	0	0
Madhya Pradesh	0	0	0	0	0	0	0	0	0	0	0	0
Madras	28 (52.8)	25 (47.2)	53 (100.0)	95 (59.4)	65 (40.6)	160 (100.0)	40 (75.5)	13 (24.5)	53 (100.0)	163 (61.3)	103 (38.7)	266 (100.0)
Maharashtra	0	0	0	0	0	0	0	0	0	0	0	0
Mysore	0	0	0	0	0	0	0	0	0	0	0	0
Orissa	0	0	0	0	0	0	0	0	0	0	0	0
Rajasthan	0	0	0	0	0	0	0	0	0	0	0	0
Uttar Pradesh	0	0	0	0	0	0	0	0	0	0	0	0
West Bengal	0	0	0	0	0	0	0	0	0	0	0	0
All States sample	28 (52.8)	24 (47.2)	53 (100.0)	1261 (83.9)	242 (16.1)	1503 (100.0)	270 (82.6)	57 (17.4)	327 (100.0)	1559 (82.8)	324 (17.2)	1883 (100.0)

TABLE C—6  
Percentage Distribution of Minor Works of Different Type and Nature of Irrigation Provided by Them in 1960-61

Sample areas in States	Type of works											
	Tank			Well			Others			All works*		
	Perennial	Kharif only	Rabi only	Perennial	Kharif only	Rabi only	Perennial	Kharif only	Rabi only	Perennial	Kharif only	Rabi only
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Andhra												
Pradesh	53.0	47.0	0.0	100.0	0.0	0.0	50.0	50.0	0.0	96.2	3.8	0.0
Assam	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Bihar	6.2	12.5	81.3	50.7	0.0	49.3	60.0	40.0	0.0	47.4	4.6	48.0
Gujarat	0.0	0.0	100.0	100.0	0.0	0.0	0.0	0.0	0.0	99.3	0.0	0.7
Kerala	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0
Madhya												
Pradesh	20.0	50.0	30.0	66.5	0.0	33.5	100.0	0.0	0.0	65.8	1.3	32.9
Madras	0.0	0.0	100.0	68.3	0.0	31.7	0.0	0.0	0.0	64.5	0.0	35.4
Maharashtra	0.0	0.0	0.0	100.0	0.0	0.0	33.3	0.0	66.7	94.6	0.0	5.4
Mysore	40.0	60.0	0.0	98.9	1.1	0.0	100.0	0.0	0.0	97.4	2.6	0.0
Orissa	0.0	100.0	0.0	90.7	5.2	4.1	33.3	33.3	33.3	85.0	10.8	4.2
Punjab	0.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0
Rajasthan	0.0	0.0	100.0	43.6	0.0	56.4	0.0	0.0	0.0	43.4	0.0	56.6
Uttar												
Pradesh	4.6	0.0	95.4	92.2	5.5	2.3	100.0	0.0	0.0	79.6	4.6	15.8
West Bengal	100.0	0.0	0.0	16.3	0.0	83.7	12.5	50.0	37.5	56.9	6.9	36.2
All States												
sample	51.4	24.1	24.5	83.3	0.6	16.1	56.3	22.5	21.2	80.5	2.7	16.8

\*Excludes canal

TABLE C-7  
*Net Irrigable Area as % of Net Cultivated Area in 1959-60, by Type of Works—State-wise*

Sample areas in States	Works				All sources
	Tank	Well	Tubewell	Others	
(1)	(2)	(3)	(4)	(5)	(6)
Andhra Pradesh ..	29.5	10.8	0.0	0.4	40.7
Assam ...	0.0	0.0	0.0	11.2	11.2
Bihar ..	4.5	10.5	12.6	32.8	60.3
Gujarat ..	1.2	10.6	0.0	0.0	11.8
Kerala ..	2.9	1.1	0.0	1.8	5.8
Madhya Pradesh ..	1.7	10.0	0.0	0.1	11.8
Madras ..	15.2	6.3	0.0	0.0	21.9
Maharashtra ..	0.0	2.3	0.0	32.0	34.2
Mysore ..	19.8	14.6	0.0	0.0	34.4
Orissa ..	32.2	0.9	0.0	5.6	38.7
Punjab ..	0.0	40.5	41.7	2.2	84.5
Rajasthan ..	0.4	16.9	0.0	0.0	17.4
Uttar Pradesh ..	2.6	13.7	4.1	0.0	20.4
West Bengal ..	2.1	0.6	0.2	29.0	31.9
All States sample	7.0	10.6	3.4	8.4	29.4

TABLE C—8  
*Distribution of Sown Area by Crops, along with Proportion of Area Irrigated for Each Crop, 1955-56 to 1959-60—State :  
 Andhra Pradesh*

Year	Percentage of gross cropped area irrigated	Paddy	Wheat	Sugarcane	Cotton	Jowar	Bajra	Maize	Ground- nut	Gram	Potato	Others
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1955-56	.. 43.8	a 39.9 b 95.8	0.0	*	0.1 0.0	11.8 0.0	0.0	8.4 19.5	11.4 0.0	0.0	0.0	28.4 13.7
1956-57	.. 43.9	a 39.9 b 96.2	0.0	0.0	0.1 0.0	11.9 0.0	0.0	8.2 17.8	10.2 0.0	0.0	0.0	29.7 13.6
1957-58	.. 39.0	a 33.4 b 96.3	0.0	0.0	0.1 0.0	23.0 0.0	0.0	8.2 54.2	10.5 0.0	1.0 0.0	0.0	23.8 9.8
1958-59	.. 38.9	a 33.4 b 96.1	0.0	0.0	0.1 0.0	24.3 0.0	0.0	9.7 42.5	4.1 0.0	0.5 0.0	0.0	27.9 9.4
1959-60	.. 40.4	a 34.4 b 95.8	0.0	0.0	0.1 0.0	20.6 0.0	0.2 0.0	12.8 38.2	3.6 0.0	0.6 0.0	0.0	27.7 9.0

a = Percentage of area under a crop to total gross cropped area.

b = Percentage of irrigated area under a crop to total area under that crop

\* = Negligible.



TABLE C-9  
Distribution of Sown Area by Crops, along with Proportion of Area Irrigated for Each Crop, 1955-56 to 1959-60—State : Bihar

Year	Percentage of gross cropped area irrigated	Paddy	Wheat	Sugarcane	Cotton	Jowar	Bajra	Maize	Ground-nut	Gram	Potato	Others
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1955-56	..	a 25.0 b 100.0	10.1 6.2	3.2 100.0	0.0 —	10.1 0.0	0.0 —	10.8 0.0	0.0 —	5.2 0.0	1.3 100.0	34.3 0.0
1956-57	..	a 34.3 b 84.2	10.6 15.5	1.9 100.0	0.0 —	5.6 0.0	0.0 —	8.1 0.0	0.0 —	6.1 1.3	1.3 83.9	32.1 0.0
1957-58	..	a 35.5 b 86.6	11.1 24.9	3.0 96.8	0.0 —	5.7 0.0	0.0 —	8.5 0.0	0.0 —	4.6 2.1	0.8 100.0	33.7 1.9
1958-59	..	a 33.9 b 83.2	8.0 32.0	3.1 94.0	0.0 —	4.7 0.0	0.0 —	10.1 0.0	0.0 —	4.2 4.4	0.5 100.0	35.6 4.4
1959-60	..	a 29.1 b 81.3	9.0 36.9	3.8 96.6	0.0 —	5.2 0.0	0.0 —	10.9 0.0	0.0 —	5.2 3.8	0.5 100.0	36.3 4.0

a = Percentage of area under a crop to total gross cropped area.

b = Percentage of irrigated area under a crop to total area under that crop.

TABLE C-10

*Distribution of Sown Area by Crops, along with Proportion of Area Irrigated for Each Crop, 1955-56 to 1959-60—State : Gujarat*

Year	Percentage of gross cropped area irrigated		Paddy	Wheat	Sugarcane	Cotton	Jowar	Bajra	Maize	Ground-nut	Gram	Potato	Others
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1955-56	..	a 4.8	8.8	1.1	39.0	0.8	5.4	25.1	8.4	3.0	0.0	3.6	
		b 0.0	100.0	0.0	0.0	0.0	0.0	9.2	0.0	0.0	—	0.0	
1956-57	..	a 10.0	6.0	0.5	46.3	5.2	5.6	11.3	12.2	2.2	0.0	0.7	
		b 0.0	100.0	100.0	1.4	0.0	1.8	16.4	0.0	0.0	—	0.0	
1957-58	..	a 6.8	5.2	0.6	36.2	3.8	8.0	20.2	17.4	0.2	0.0	1.6	
		b 0.0	100.0	100.0	2.0	0.0	0.0	10.8	0.0	0.0	—	0.0	
1958-59	..	a 6.9	6.4	0.3	34.4	3.7	7.6	19.8	16.2	1.7	0.0	3.0	
		b 0.0	100.0	100.0	5.0	0.0	2.5	2.6	0.0	0.0	—	0.0	
1959-60	..	a 11.3	6.9	0.4	36.3	3.3	4.6	12.5	20.6	1.3	0.0	2.8	
		b 0.0	100.0	100.0	4.6	0.0	0.0	9.8	0.0	0.0	—	0.0	

a= Percentage of area under a crop to total gross cropped area.

b= Percentage of irrigated area under a crop to total area under that crop.

TABLE C-11  
*Distribution of Sown Area by Crops, along with Proportion of Area Irrigated for Each Crop, 1955-56 to 1959-60—State : Kerala*

Year	Percentage of gross cropped area irrigated		Paddy	Wheat	Sugarcane	Cotton	Jowar	Bajra	Maize	Ground-nut	Gram	Potato	Others
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1955-56	..	5.8	a 43.3 b 10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.7 2.6
1956-57	..	6.3	a 43.3 b 11.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.7 2.6
1957-58	..	6.6	a 43.0 b 11.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57.0 2.6
1958-59	..	6.5	a 42.7 b 11.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57.3 2.6
1959-60	..	6.5	a 42.7 b 11.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57.3 2.6

a = Percentage of area under a crop to total gross cropped area.  
 b = Percentage of irrigated area under a crop to total area under that crop.

TABLE C—12

*Distribution of Sown Area by Crops, along with Proportion of Area Irrigated for Each Crop, 1955-56 to 1959-60—State :  
Madhya Pradesh*

Year	Percentage of gross cropped area irrigated		Paddy	Wheat	Sugarcane	Cotton	Jowar	Bajra	Maize	Ground-nut	Gram	Potato	Others
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(13)
1955-56	..	a 17.9 b 12.3	12.8 13.4	0.2 96.9	8.5 6.2	7.6 0.0	0.8 0.0	7.0 0.0	6.0 0.0	9.1 4.7	0.0 —	30.1 7.0	
1956-57	..	a 17.7 b 11.9	11.6 13.4	0.4 74.1	6.8 6.3	6.2 0.0	0.9 0.0	6.4 0.0	7.5 0.0	10.4 2.9	0.0 —	32.1 9.1	
1957-58	..	a 18.0 b 14.9	12.3 12.8	0.3 71.1	7.4 6.8	5.8 0.0	0.7 0.0	7.3 0.0	7.9 0.0	10.3 4.1	0.0 —	30.0 8.7	
1958-59	..	a 17.7 b 12.1	10.3 18.4	0.2 87.5	5.9 6.1	6.6 0.0	0.6 0.0	7.0 0.3	11.7 0.0	8.1 5.3	0.0 —	31.9 8.7	
1959-60	..	a 17.4 b 37.7	10.0 21.0	0.2 93.1	7.5 4.7	5.4 12.3	0.4 0.0	7.8 0.0	8.8 0.0	10.7 7.7	0.0 —	31.8 9.2	

a = Percentage of area under a crop to total gross cropped area.

b = Percentage of irrigated area under a crop to total area under that crop.

TABLE C-13

*Distribution of Sown Area by Crops, along with Proportion of Area Irrigated for Each Crop, 1955-56 to 1959-60—State : Madras*

Year	Percentage of gross cropped area irrigated	Paddy	Wheat	Sugarcane	Cotton	Jowar	Bajra	Maize	Ground-nut	Gram	Potato	Others
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1955-56	..											
1956-57	45.1	a 22.1 b 99.2	0.0	0.5 100.0	13.6 50.6	6.3 100.0	11.3 1.4	0.0	4.8 6.1	0.0	0.0	41.1 21.7
1957-58	51.6	a 28.7 b 100.0	0.0	0.8 100.0	14.4 34.8	7.3 100.0	11.4 0.7	0.0	0.4 32.6	0.0	0.0	37.0 25.8
1958-59	52.4	a 25.6 b 100.0	0.0	1.3 100.0	16.0 48.3	3.7 100.0	6.3 2.3	0.0	8.3 17.2	0.0	0.0	38.8 32.8
1959-60	34.0	a 24.3 b 71.6	0.0	0.6 100.0	19.3 62.9	9.0 28.5	10.8 3.5	0.0	2.9 28.6	0.5 1.9	0.0	32.6 22.9

a= Percentage of area under a crop to total gross cropped area.

b= Percentage of irrigated area under a crop to total area under that crop.

TABLE C-14  
*Distribution of Sown Area by Crops, along with Proportion of Area Irrigated for Each Crop, 1955-56 to 1959-60—State :  
 Maharashtra*

Year	Percentage of gross cropped area irrigated		Paddy	Wheat	Sugarcane	Cotton	Jowar	Bajra	Maize	Ground-nut	Gram	Potato	Others
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1955-56	..	5.0	a 0.9 b 92.3	22.5 7.9	0.8 100.0	17.1 0.0	25.1 0.0	11.2 0.0	0.0 —	6.5 0.0	8.7 5.6	0.0 —	7.2 15.7
1956-57	..	4.3	a 0.9 b 90.0	19.4 5.7	1.3 100.0	16.7 0.0	26.1 0.0	12.3 0.0	0.0 —	8.2 0.0	7.3 6.1	0.0 —	7.8 7.5
1957-58	..	5.5	a 1.0 b 91.2	15.7 9.2	0.9 100.0	11.3 0.0	27.7 0.0	12.3 0.0	0.0 —	12.2 0.0	7.2 6.8	0.0 —	11.7 15.0
1958-59	..	5.7	a 1.5 b 96.4	14.9 10.9	0.7 100.0	10.5 0.0	28.1 0.0	10.3 0.0	0.0 —	18.5 0.0	5.4 8.5	0.0 —	10.1 14.4
1959-60	..	8.9	a 1.1 b 81.5	16.7 21.0	1.5 100.0	4.4 0.0	27.6 0.0	11.4 0.0	0.0 —	22.2 0.0	5.4 11.5	0.0 —	9.7 24.0

a= Percentage of area under a crop to total gross cropped area.  
 b= Percentage of irrigated area under a crop to total area under that crop.

TABLE C-15

*Distribution of Sown Area by Crops, along with Proportion of Area Irrigated for Each Crop, 1955-56 to 1959-60—State : Mysore*

Year	Percentage of gross cropped area irrigated		Paddy	Wheat	Sugarcane	Cotton	Jowar	Bajra	Maize	Ground-nut	Gram	Potato	Others
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1955-56	..	21.7	a 9.0 b 42.7	0.0	0.0	0.0	3.5	0.0	0.0	3.1	0.0	3.7	80.7
1956-57	..	26.6	a 4.6 b 56.9	0.0	0.0	0.0	6.0	0.0	0.0	1.2	0.0	3.5	84.7
1957-58	..	20.6	a 8.4 b 51.1	0.0	0.0	0.0	2.0	2.4	0.0	5.2	0.0	3.4	78.6
1958-59	..	18.6	a 14.8 b 35.0	0.0	0.0	0.0	2.2	2.4	0.0	7.1	0.0	1.3	72.2
1959-60	..	22.9	a 11.5 b 60.0	0.0	0.0	0.0	2.9	1.5	0.0	5.6	0.0	1.9	76.6

a = Percentage of area under a crop to total gross cropped area.  
b = Percentage of irrigated area under a crop to total area under that crop.

TABLE C-16 .  
*Distribution of Sown Area by Crops, along with Proportion of Area Irrigated for Each Crop, 1955-56 to 1959-60—State : Orissa*

Year	Percentage of gross cropped area irrigated	Paddy	Wheat	Sugarcane	Cotton	Jowar	Bajra	Maize	Ground-nut	Gram	Potato	Others
1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
55-56	..	34.7	a 77.6 b 43.0	0.0	0.8 87.5	0.0	0.0	0.0	0.1 0.0	7.5 0.0	0.7 76.2	13.3 0.5
56-57	..	28.6	a 73.1 b 36.8	0.0	1.0 87.0	0.0	0.0	0.0	0.5 0.0	8.1 0.0	0.9 76.2	16.4 0.5
57-58	..	31.9	a 82.9 b 36.6	0.0	0.6 100.0	0.0	0.0	0.0	0.6 0.0	4.2 0.0	1.1 77.3	10.6 1.4
58-59	..	28.1	a 72.4 b 36.8	0.0	0.6 80.0	0.0	0.0	0.0	0.5 0.0	9.3 0.0	1.0 78.3	16.2 0.8
59-60	..	33.3	a 76.5 b 42.0	0.0	0.4 100.0	0.0	0.0	0.0	0.3 0.0	8.9 0.0	0.8 79.2	13.1 0.8

a= Percentage of area under a crop to total gross cropped area.

b= Percentage of irrigated area under crop to total area under that crop.



TABLE C-17  
*Distribution of Sown Area by Crops, along with Proportion of Area Irrigated for Each Crop, 1955-56 to 1959-60—State : Punjab*

Year	Percentage of gross cropped area irrigated		Paddy	Wheat	Sugarcane	Cotton	Jowar	Bajra	Maize	Ground-nut	Gram	Potato	Others
	(2)	(3)											
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	
55-56	..	51.5	a 3.4 b 20.7	25.0 74.5	3.6 80.4	11.2 69.2	0.0 —	7.6 67.8	3.0 0.0	9.5 6.4	0.0 —	36.7 43.0	
56-57	..	53.6	a 3.4 b 23.7	17.6 66.1	2.9 85.4	14.7 95.4	0.0 —	6.7 71.4	2.8 0.0	6.9 7.0	0.0 —	45.0 43.2	
57-58	..	46.2	a 3.1 b 13.0	20.1 73.2	3.3 79.9	13.4 87.0	0.0 —	5.7 53.3	5.8 0.0	8.5 7.5	0.0 —	40.1 32.8	
58-59	..	52.3	a 3.8 b 81.3	18.3 64.9	4.6 90.5	14.2 90.2	0.0 —	6.4 72.5	5.5 0.0	8.1 3.9	0.0 —	39.1 39.6	
59-60	..	49.7	a 4.1 b 41.8	19.4 63.4	4.2 68.0	15.4 91.4	0.0 —	7.2 60.3	0.6 0.0	8.7 4.9	0.0 —	40.4 34.9	

a = Percentage of area under a crop to total gross cropped area.

b = Percentage of irrigated area under a crop to total area under that crop.

TABLE C—18  
*Distribution of Sown Area by Crops, along with Proportion of Area Irrigated for Each Crop, 1955-56 to 1959-60—State : Rajasthan*

Year	Percentage of gross cropped area irrigated											
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
		Paddy	Wheat	Sugarcane	Cotton	Jowar	Bajra	Maize	Ground-nut	Gram	Potato	Others
5-56	24.6	a 0.0 b —	18.6 97.7	0.3 100.0	0.3 100.0	21.1 0.3	14.7 0.0	0.8 61.0	0.0 —	16.5 0.1	0.0 —	27.7 19.1
6-57	23.8	a 0.0 b —	20.9 81.6	0.2 100.0	0.3 100.0	18.5 0.0	16.5 0.0	0.5 71.8	0.1 0.0	17.2 0.0	0.0 —	25.8 22.5
7-58	21.7	a 0.0 b —	14.8 95.3	0.3 100.0	0.2 81.5	25.3 0.0	13.1 0.0	1.0 75.9	0.2 0.0	14.3 0.2	0.0 —	30.8 20.5
8-59	22.2	a 0.0 b —	16.1 80.9	0.2 100.0	0.7 89.6	23.3 0.0	15.2 0.0	1.1 55.9	0.1 0.0	10.8 0.2	0.0 —	32.5 23.8
9-60	18.6	a 0.0 b —	16.0 78.8	0.2 100.0	0.3 72.3	16.3 0.0	16.6 0.0	0.7 35.0	0.2 0.0	14.8 0.2	0.0 —	34.9 15.3

a= Percentage of area under a crop to total gross cropped area.  
 b= Percentage of irrigated area under a crop to total area under that crop.

TABLE C—19  
Distribution of Sown Area by Crops, along with Proportion of Area Irrigated for Each Crop, 1955-56 to 1959-60—State : Uttar Pradesh

Year	Percentage of gross cropped area irrigated	Paddy	Wheat	Sugarcane	Cotton	Jowar	Bajra	Maize	Ground-nut	Gram	Potato	Others
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
55-56	..	36.7 a 20.6 b 18.4	23.0 31.7	15.2 87.5	0.2 6.2	0.3 0.0	0.8 0.0	2.5 0.0	0.0 —	6.1 29.8	* 100.0	31.3 33.6
56-57	..	34.5 a 22.0 b 18.3	25.7 30.4	17.0 85.7	0.3 6.2	0.4 0.0	0.4 0.0	0.5 0.0	0.0 —	5.7 24.2	0.1 100.0	27.9 23.9
57-58	..	35.8 a 23.3 b 21.9	22.1 36.0	16.7 80.0	0.1 16.7	0.4 0.0	0.5 0.0	0.7 6.5	0.0 —	9.3 14.7	0.1 100.0	26.8 29.6
58-59	..	27.9 a 24.0 b 23.5	24.4 13.4	16.0 78.6	0.1 100.0	0.6 0.0	1.1 0.0	0.4 0.0	0.0 —	8.8 10.7	0.1 100.0	24.5 22.1
59-60	..	30.4 a 24.6 b 23.1	22.6 17.3	16.4 85.5	0.1 16.7	0.3 0.0	0.8 0.0	0.6 2.5	0.0 —	8.4 11.4	0.1 75.0	26.1 22.1

a = Percentage of area under a crop to total gross cropped area.  
b = Percentage of irrigated area under a crop to total area under that crop.  
\* = Negligible.

TABLE C—20  
*Distribution of Sown Area by Crops, along with Proportion of Area Irrigated for Each Crop, 1955-56 to 1959-60—State: West Bengal*

Year	Percentage of gross cropped area irrigated	Paddy	Wheat	Sugarcane	Cotton	Jowar	Bajra	Maize	Ground-nut	Gram	Potato	Others
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
955-56	..	26.3	a 71.4 b 33.1	0.5 0.0	0.3 100.0	0.0 —	0.0 —	0.0 —	0.0 —	0.0 —	0.8 100.0	27.0 5.9
956-57	..	27.2	a 71.2 b 34.4	0.5 0.0	0.3 100.0	0.0 —	0.0 —	0.0 —	0.0 —	0.0 —	0.8 100.0	27.2 5.8
957-58	..	26.4	a 74.4 b 33.0	0.4 0.0	0.1 75.0	0.0 —	0.0 —	0.0 —	0.0 —	0.0 —	0.4 100.0	24.7 5.5
958-59	..	23.6	a 72.6 b 33.1	0.4 0.0	0.2 54.6	0.0 —	0.0 —	0.0 —	0.0 —	0.0 —	0.4 100.0	26.4 4.3
959-60	..	23.6	a 73.4 b 26.9	0.4 0.0	0.2 39.1	0.0 —	0.0 —	0.0 —	0.0 —	0.0 —	0.4 100.0	25.6 5.2

a = Percentage of area under a crop to total gross cropped area.

b = Percentage of irrigated area under a crop to total area under that crop.

TABLE C-21  
Proportion of Irrigable Area Irrigated in 1959-60 by Type of Works and Seasons—State-wise

Irrigable areas in States	Works															
	Tanks		Pucca wells		Kutcha wells		Tube-wells		Pump sets		Others		Total			
	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Uttar Pradesh ..	111.9	116.9	10.3	68.2	0.9	71.4	0.0	0.0	0.0	0.0	100.0	45.0	78.7	84.2		
Madhya Pradesh ..	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.6	0.0	0.0	0.0	32.6		
West Bengal ..	80.4	38.6	15.1	62.8	0.0	33.3	37.0	38.1	0.0	0.0	85.3	0.0	61.6	49.0		
Rajasthan ..	0.0	96.7	54.8	69.1	14.8	95.1	0.0	0.0	0.0	0.0	0.0	0.0	47.1	76.4		
Gujarat ..	0.0	100.0	0.0	56.8	0.0	90.7	0.0	0.0	0.0	0.0	0.0	47.9	0.0	76.4		
Karnataka ..	88.4	48.4	0.8	73.1	5.1	65.7	0.0	0.0	0.0	0.0	100.0	10.5	10.5	69.5		
Andhra Pradesh ..	0.0	100.0	73.3	23.9	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	65.5	80.0		
Tamil Nadu ..	0.0	0.0	68.0	16.6	15.6	72.2	0.0	0.0	0.0	0.0	30.5	61.8	32.5	59.2		
Kerala ..	96.1	194.8	100.0	99.1	100.0	100.0	0.0	0.0	0.0	0.0	100.0	0.0	97.9	114.2		
Goa ..	38.2	0.0	13.0	76.1	12.5	77.5	0.0	0.0	0.0	0.0	93.3	3.1	45.7	15.0		
Orissa ..	0.0	0.0	68.9	59.2	0.0	0.0	22.4	35.4	39.7	42.6	0.0	0.0	45.2	47.0		
Assam ..	0.0	87.1	6.8	91.8	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	91.8		
West Bengal ..	0.0	72.7	60.6	82.3	0.0	100.0	100.0	75.0	0.0	0.0	0.0	0.0	69.7	79.5		
Bihar ..	131.8	131.7	0.0	100.0	0.0	100.0	0.0	100.0	0.0	0.0	27.3	172.7	30.9	164.9		
States sample	94.8	97.4	37.9	69.8	8.9	75.2	30.7	38.7	39.7	36.0	45.5	73.6	45.9	69.7		

TABLE C-22  
*Distribution of Villages by the Nature of Problems in the Way of Creating New Irrigation Facilities*

Item	Villages with well			Villages with both tank and well			Villages with tank			Villages with works other than tank and well			All villages	
	No.	%	States where reported and number of villages	No.	%	States where reported and number of villages	No.	%	States where reported and number of villages	No.	%	States where reported and number of villages	No.	%
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
<i>of Irrigation extension :</i>														
Villages where irrigation is not needed.	—	—	—	—	—	—	—	—	—	1	6.7	Kerala	1	0.8
Villages with scope of further extension but reporting one or more problems.	37	67.3	Rajasthan—11, Punjab—6, Maharashtra—4, West Bengal—4, Bihar—3, U.P.—3, Gujarat—2, M.P., Madras, Mysore and Orissa—1 each.	32	76.2	Andhra—9, Madras—5, Mysore—5, Bihar—3, M.P.—3, Kerala—2, Orissa—2, U.P.—2, Rajasthan—1.	4	44.4	Andhra—2, Kerala—1, Orissa—1.	9	60.0	Assam—3, U.P.—3, Maharashtra 1, West Bengal 1, Kerala—1.	82	67.8
Villages with scope for further extension but no difficulty reported or information not available.	18	32.7	M.P.—9, Bihar—5, U.P.—2, Maharashtra—1, West Bengal—1,	10	23.8	M.P.—3, Orissa—2, U.P.—2, Andhra, Bihar, Kerala 1 each.	5	55.6	West Bengal—5	5	33.3	Assam—3, M.P.—1, West Bengal 1.	38	31.4
TOTAL	55	100.0		42	100.0		9	100.0		15	100.0		121	100.0

## Nature of Problems :

1.	Physical Problems	27	57.5	24	58.5	3	75.0	3	33.3	57	56.4
1-1	Lack of water	2	4.3	W. Bengal—1,	1	2.4	U.P.—1,	—	—	3	3.0
1-2	Sinking of wells costly due to low water table	11	23.4	Rajasthan—9, Gujarat—1, Maharashtra—1.	5	12.2	Mysore—3, Rajasthan—1, U.P.—1.	—	—	16	15.8
1-3	Salinity of water	2	4.3	Rajasthan—1, Maharashtra—1.	—	—	—	—	1	11.1	Maharashtra—1. 3 3.0
1-4	Lack of electricity or delay in electric connection	7	14.9	Punjab—4, Bihar—2, Mysore—1.	10	24.5	Andhra—6, Mysore—3, Bihar—1.	—	—	17	16.8
1-5	Works need to be fed by canal	2	4.3	West Bengal—2.	1	2.4	Andhra—1.	—	1	11.1	Kerala—1. 6 5.9
1-6	Tanks not dependable	—	—	—	6	14.6	Andhra—6,	—	—	—	6 5.9
1-7	Water-logging	1	2.1	Punjab—1,	—	—	—	—	—	—	1 1.0
1-8	Change in the river course	1	2.1	Bihar—1	—	—	—	—	—	—	1 1.0
1-9	Small and fragmented holdings	1	2.1	Rajasthan—1	1	2.4	Orissa—1	—	1	11.1	W. Bengal—1. 4 4.0
2.	Other Problems	20	42.5	—	17	41.5	—	—	6	66.7	44 43.6
2-1	Lack of finance	16	34.0	Punjab—4, Maharashtra—3, Gujarat—2, U.P.—2, and Rajasthan, M.P., Madras, Orissa and W. Bengal—1 each.	1639.1	—	Madras—6, M.P.—3, Kerala—2, Mysore—2, Orissa—2, Bihar—1.	—	2	22.3	Assam—2. 35 34.7

TABLE C-22 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
2 Lack of initiative among cultivators and lack of guidance and co-ordination	4	8.5	W. Bengal—2, Bihar—1, U.P.—1.	1	2.4	Bihar—1	—	—	—	3	33.3	Assam—3.	8	7.9
3 Ownership of land not settled	—	—	—	—	—	—	—	—	—	1	11.1	Assam—1	1.	1.0
TOTAL	47	100.0		41	100.0		4	100.0		9	100.0		101	100.0

NOTE.—Table based on 121 villages for which information is available. The remaining villages are from Gujarat (4), and Madhya Pradesh (1).



## APPENDIX D

### *Sample Design for the Block, Village and Household Stages*

1. Field investigations for this study were carried out in 21 districts purposively selected from 14 States. The method of selection of districts has been explained in Chapter II and the list of selected districts given in Appendix Table C-1. Selection at stages below the district was done according to the method of stratified random sampling explained below. In each selected district, the following areas were excluded from the frame for sampling at the lower stages :

- (a) Non-block areas
- (b) Areas covered by pre-extension blocks
- (c) Blocks which were started after 1957-58.

The remaining blocks in each district were classified into two categories according as the percentage of irrigated area in the block to the total gross cropped area there was higher or lower than the average for the district. Because of lack of data, however, in the case of Saran and Shahabad districts in Bihar, Ghazipur in U.P. and Raipur in Madhya Pradesh, the net sown area had to be substituted in place of gross cropped area for calculating the percentage. In Sabarkanta district, Gujarat, geographical area had to be used instead. From each of the two strata so formed for each district, one block was selected at random. In the case of Chattarpur district, Madhya Pradesh, the stratum with percentage lower than the district average consisted of two blocks only and both were started after 1957-58. As such the older block viz., namely Laundi started in 1958-59 was selected. In the case of Srikakulam district, Andhra, blocks in the Agency areas were excluded from the selection frame; and in Raipur district, Madhya Pradesh, only those blocks were considered where the percentage of irrigated area to gross cropped area was 5 or more. A total of 42 blocks was thus selected from 14 States excluding Jammu and Kashmir. Further details of the blocks selected are given in the Appendix Table C-1.

2. For selecting the sample villages, a list was made of the villages in each selected block uninhabited villages, villages without any source of minor irrigation and villages that had less than 15 cultivator households were excluded from the list. In the case of Trivandrum district, Kerala, 'Kara' and in the case of Jalpaiguri, West Bengal, a 'Mouza' were taken as equivalent to a census village. In Sawai Madhopur, Rajasthan, villages which were mainly labour colonies and not strictly agricultural in character, were excluded. Similarly, in Kumargram and Falakata blocks of Jalpaiguri, West Bengal, forest areas and villages frequently marooned by floods, were excluded. From the list so prepared, three villages were selected at random.

3. For the selection of respondents in the sample villages, a list was made of all cultivator households. A 'Cultivator' was defined as one who had a cultivated holding however small. The list was arranged in the descending order of size of cultivation holding and divided into five equal sections. From each section, two households were selected at random giving a total of 10 from each sample village.

4. Besides this random sample, it was considered desirable to have a purposive sample of knowledgeable persons from the sample villages. The following were included in the knowledgeable sample :

- (i) The Sarpanch of the statutory panchayat if he was a cultivator. If the Sarpanch was not a cultivator, a member of the panchayat in the sample village who was himself a cultivator was selected in his place.
- (ii) The president or secretary of an agricultural cooperative society, whoever was more knowledgeable, lived in the sample village and was a cultivator. (Office bearers of non-agricultural cooperative societies like industrial cooperatives, fishermen societies etc. were not considered for this purpose.) In case neither the president nor the secretary could thus qualify for selection, any other member of the executive or managing committee of the cooperative society satisfying the above criteria was selected instead. If more than one member of the cooperative executive came from the village, the member having the largest cultivated holding was picked up for the enquiry. In case the village was not served by a cooperative, another panchayat functionary was selected as a substitute.

(iii) Registered grower or village seed farmer. In this category only those persons were considered whose names appeared in the list (maintained by the Block) of the farmers approved for getting foundation seeds for multiplication, and who had actually received such seeds multiplied them on their farms and then made available the registered improved seed for further distribution, any time during the two agricultural years 1958-59 and 1959-60. In case not even a single person in the selected village satisfied the above criteria, the conditions were relaxed to have in the knowledgeable sample those persons in the block list of approved farmers who had received some improved seeds for propagation.

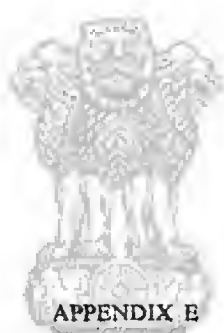
(iv) Gram Sahayak : Only those persons were considered, who had attended at least one full course (for the entire duration) of the Gram Sahayak Camp in any period upto June, 1959. Sometimes, it was found that all persons from the village where the Camp was held attended the Camp on the inaugural day but did not turn up subsequently. For our selection, such persons were excluded. Wherever the practice in the blocks was to issue certificates to the persons who had completed the Gram Sahayak training, only those who had received such certificates, were considered. In case more than one person satisfied the above criteria, the person who was considered the best Gram Sahayak by the VLW, was selected. On the other hand, if no Gram Sahayak was found in the sample village satisfying the above criteria, the person suggested by the VLW as equivalent to Gram Sahayak, was picked up.

(v) Patwari : In areas where there were no patwaris, the revenue functionary covering the village was picked up, failing which, a progressive farmer was selected.

(vi) Primary School Teacher, provided he resided in the village and was a cultivator. If no such teacher was available, a progressive farmer was substituted in his place.

5. The following table presents the number of households selected in the random and the knowledgeable samples respectively. Of the total number of knowledgeable persons in the sample, 124 represented functionaries of panchayats and 119 of cooperatives.

State	No. of households in Random sample	No. in the sample of knowledgeable persons
Andhra Pradesh	119	72
Assam	58	16
Bihar	120	66
Gujarat	60	36
Kerala	60	36
Madhya Pradesh	180	87
Madras	60	36
Maharashtra	60	36
Mysore	60	36
Orissa	58	36
Punjab	60	33
Rajasthan	120	68
Uttar Pradesh	120	72
West Bengal	120	72
Total	1,255	702



#### **APPENDIX E**

*Schedules, questionnaire and Proforma for the Collection of Information on  
Minor Irrigation*

1. Guide Points for Block/State Note on Irrigation.
2. Additional Guide Points for State Note on Irrigation.
3. Village schedule on Irrigation and Multiple Cropping.
4. Household schedule (H-I) on Irrigation and Multiple Cropping.
5. Household Questionnaire (H-II) on Irrigation and Multiple Cropping.
6. Proforma on Minor Irrigation for collecting information from State Governments..

**PROGRAMME EVALUATION ORGANISATION  
(PLANNING COMMISSION)**

**GUIDE POINTS FOR BLOCK/STATE NOTE ON IRRIGATION**

**1. Background Data :**

- 1.1. Annual rainfall for the last five years (either at the block headquarter or at the nearest recording station)**

Item	Total (in acres)	Within command of canal (in acres)
1.2. Block area (Geographical) .. .. .		
1.3. Total cultivated area .. .. .		
1.4. Cultivated area under heavily irrigated crops :		
Total		
Paddy		
Sugarcane		
.....		
1.5. Cultivated area under lightly irrigated crops :		
.....		
.....		
.....		
.....		
1.6. Area suitable (considering the type of soil) for heavily irrigated crops :		
Total		
Paddy		
Sugarcane		
.....		
1.7. Area suitable (considering the type of soil) for lightly irrigated crops :		
Total		
.....		
.....		
.....		
1.8. Area sown more than once .. .. .		
1.9. Water-logged area .. .. .		
1.10. Area with alkaline deposits .. .. .		
1.11. Requirements of irrigation water (in acre-inches) for :		
Paddy		
Sugarcane		
Wheat		
.....		

1.12. Volume of water made available by the major project

1.13. Volume of water utilized from the major project

1.14. Net area irrigated by sources (Canals, tube-wells, tanks, other sources)

1.15. Area irrigated by major crops

Crops :					
Area irrigated (acres)					

1.16. Area irrigated per cusec from the major project :

Division level

Project level

1.17. Loans given for land development :

Heavy crops

Light crops

Amount of loan

Area covered by loan

Per acre given

Per acre required

2. Give for the last five years :

Year	Block level						Divisional level		Major project	
	Culti- vated area	Potential created		Area irri- gated		Water rates charg- ed	Poten- tial creat- ed	Net area irri- gated	Poten- tial crea- ted	Net area irri- gated
		Kha- rif	Rabi	Kha- rif	Rabi					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
.....										
.....										
.....										
.....										
.....										
.....										

### Problems on Canal Irrigation

#### 3. Cropping Pattern :

(i) What cropping pattern is assumed by the irrigation authorities in planning the project and calculating the irrigation potential ? How it differs from the actual pattern followed by cultivators in utilization of the irrigation water ? Give the exact ratios of the heavily irrigated crops (like paddy, sugarcane) to lightly irrigated crops and the acreages involved.

(ii) Whether the cultivators prefer lightly irrigated crops or heavily irrigated crops ? Factors behind cultivators preference like (1) paddy more profitable, (2) paddy needed for self-consumption, (3) the light crops like..... give less yield from canal water than from well water, etc.

(iii) Measures taken, if any, by the Government as a result of the actual pattern deviating from assumed pattern [like (1) heavy irrigation to Kharif only but light irrigation in both seasons, (2) night system for heavy irrigation, etc.]..

(iv) Are the areas of heavy irrigation inter-mixed with areas of light irrigation ? Does this affect, by seepage, the lightly irrigated crops as in Madras ?

4. What is the irrigation potential in the Block area at the channel outlets ?

(a) assuming cropping pattern envisaged by the canal authorities.

(b) assuming cropping pattern practised or preferred at present by cultivators.

Has any demonstration been held to propagate the pattern of canal authorities ? Are there demonstration-cum-trial projects ? How are they functioning ?

5. (a) Out of the cultivated area in the command of canal, which is not irrigated at present, how much area actually needs irrigation ?

(b) Can the present supply of water cover larger area ? How efficient is this canal project in the Block area i.e. how does area irrigated per cusec of water compare with other similar projects ? Have any special measures or suggestions been put forward to increase efficiency in this sense. Has this efficiency varied over time ? Give for the past five years.

(c) Is there any proposal or suggestion to lighten irrigation in the Block area ? If so, what is it ? During the last five years can we say if there has been in the area deepening of irrigation (more watering per acre for the same crop). Give for the last five years.

(d) Will canal irrigation be the more economic source of irrigation to the farmers for the land still unirrigated (in the canal command) ? Compare the relative economics of sources of irrigation and examine their possibilities.

(e) Is there any scheme to increase in the Block area the irrigation potential at the channel outlets ? Lift schemes etc. ?

(f) Can the irrigation potential in the area be increased by

(i) Proper maintenance of the existing minor irrigation works;

(ii) by having more field channels ?

(g) How has the introduction of canal irrigation affected the use of water from older irrigation works (i) tanks, (ii) wells (iii) other.

6. (i) System of spread of irrigation (distribution of water)—what is followed ?

(a) Whether water for heavily irrigated crops like paddy, sugarcane, is supplied during 11 hrs. of the night and for the lightly irrigated crops during the remaining 13 hrs. of the day (as in Mysore) or there is 24 hrs. continuous water supply for both the types of crops. What is the reaction of the cultivator ?

(b) Are areas demarcated according as canal water can be used (i) only for heavily irrigated crops, (ii) for lightly irrigated crops ? What is the system followed if the cultivator wants to have paddy or sugarcane in the areas of latter category ? Is there the system of permits ? How much has it been availed of ?

(c) Are there in the scheme of irrigation authorities, blank areas or dry areas between wet areas for heavy crops and light crops ? Does that create special problems for the (i) cultivators in taking the field channels, (ii) the authorities in checking unauthorized irrigation ? What is being done about them ?

(ii) What is the system of irrigation like ? 'field to field flow' or through field channels. Why do the farmers prefer the first one in some areas (as in Kerala) ? Any complaints about canal water being hot ?

(iii) Is there equitable distribution of the canal water in the upper and lower parts of the canal ? Do fields situated on the tail end suffer from inadequate supply of water ? What precautions, if any, have been taken ? Give details.

7. System of water rates : (i) compulsory or optional. Give details (ii) were concessional water rates given since water was made available ? Give details.

8. *Betterment Levy* :

(i) Has betterment levy been imposed after the completion of irrigation scheme in the area ? yes/no.

(ii) If 'Yes', is it imposed on all cultivators of the area or only on the beneficiaries ?

(iii) What are the upper and lower limits for the levy ?

(iv) When was water available from the scheme and from when the levy is expected to be paid ? Any grace period and concession rates.

(v) How is this levy fixed ? Is it on per acre basis ? Does it vary with the crops grown or with the soil type ?

(vi) How are the following factors taken into account in determining the levy : (a) prospective rise in value of land (b) cost increase in converting dry land to wet land (c) cost of irrigation works. Explain the levy system.

(vii) Has it remained the same from the beginning of the scheme ?

- (viii) System of collection.
- (ix) What has been the reaction of the cultivators in the area to such a levy?
- (x) Has it resulted in more litigation?
- (xi) Has it damped initiative of the farmers to take advantage of canal water?
- (xii) Has this brought about any change in the cropping pattern of the area? Give the direction of change.

#### 9. Problems on Field Channels :

(i) What is the normal practice and Government responsibility in the matter of (a) construction of field channels (b) acquisition of land for field channels (e.g. in Madras State, normal practice is to construct field channels upto 150 acre blocks except in under-developed areas where this limit is brought down to 50 acres and in bad cases to 25 acre blocks)? Is there any difference in this respect between better and worse areas (better in respect of soil, better in the sense cultivators are prosperous)?

(ii) Have the field channels been created so much ahead of their utilization that they were likely to be obliterated?

(iii) What are the obligations and responsibilities of the beneficiaries (how it differs between better and worse areas; between type of works etc.)?

(iv) Has the Govt. framed any rules making it obligatory on the part of the beneficiaries to construct and maintain field channels? What are the important provisions of the rules?

Which agency is responsible for enforcing the fulfilment of these obligations? Are these rules enforced in practice?

If not, is there any provision in the law for the Govt. to construct field channels and maintain these and recover the cost from the defaulters?

(v) Is financial assistance provided for construction of field channels, water courses etc.? What is the agency providing such assistance? What are the conditions imposed for the issue of these loans/grants? Are they related to the land ownership? Are they adequate to meet the demands? If not, has this been a major handicap in the proper utilization of the canal water?

#### 10. Any special problem of the area concerning :

(i) Works going out of use either because they are superfluous or ineffective or because alternative facilities exist;

(ii) Replacement of irrigation works like oil engine, tube-wells and pump sets to be replaced by electric tube-wells after areas got electricity or replacement of 'sentra' method well by 'gola' method pucca well on which pump set can be installed;

(iii) Rationalization of the locations of the existing works;

(iv) Waste of existing water resources because of certain practices (as in the 'Bandhis') of M.P. where stored rain water is drained off in October and then wheat sown in the beds; the possibility for utilizing it for irrigating late paddy etc. is not explored);

(v) Scarcity of certain essential materials like steel shortage, etc. which stand in the way (a) of creation of potential (b) of creation of community owned minor work;

(vi) New plant diseases (if any) developing as a result of new irrigation facilities. What are the new types of diseases; are such types associated with any particular crop? What is being done to tackle this problem?

(vii) Others.

#### Minor Irrigation Works :

11. Are there different departments/agencies handling minor irrigation programmes? Give details. How are they co-ordinated at present?

12. What is the system of maintenance for minor irrigation works? Describe. How far the recent land reforms (Abolition of zamindari etc.) affected the system and method of maintenance? Does the present system consider tanks etc. that have been taken over from old zamindars as a special category and give them special treatment? Discuss.

13. To what extent construction of minor irrigation works are entrusted to local agencies like panchayat and cooperative? Any special measures have been taken by the Government to enable these institutions to take up such works. (Measures like relaxation of normal procedure of security deposit in respect of contracts, advancing initial finances to serve as revolving fund).

Whether any labour cooperatives have been formed ? If so, how are they functioning ?

14. How far these institutions have actually taken up the construction works ?

15. Has adequate attention been paid to drainage works under minor irrigation programme to counteract the ill-effects of water-logging, alkalinity and salinity ?

16. Has the Block set up common facility workshops for repairs to engines, pumps and other lift appliances ? Comment individually on their functioning ? How many technicians have they ? Have they mobile units ? Do they help the cultivators in repairing their engines, pumps etc. on payment basis ? Are the technicians allowed to have a portion of the charges realized in this way ? What portion ?

17. Have some farmers been trained in handling mechanical equipments like engines, pumps etc. ? Where was the training given (as a part of the training of Gram Sahayaks or otherwise) ? Explain how effective was the training.

18. Is there any Block plan for extension of minor works programme ? How far there is realistic planning for maximum works programme and full utilization of available manpower ?

19. What portion of the total provision in the Block budget under 'agriculture, minor irrigation and land improvement' has been earmarked for minor irrigation ? Give for the last five years (1955-56—1959-60). Give for the last five years the budget provisions and actual expenditures under this head. If the proportion was less than two-thirds, are there any special conditions which justify the allocation ?

20. What is the proportion of actual expenditure on minor irrigation to the total on 'agriculture, minor irrigation and land improvement' for the last five years ? Comment.

21. To what extent community owned minor irrigation works have been created from Block funds ?

#### *Problems of Co-ordination:*

22. Problems, if any, which stood in the way of irrigation because of their inter-block or inter-district nature.

23. Lack of co-ordination between irrigation, forest, agriculture and finance authorities. Give significant cases.

24. Functioning of Development Committees, or Working Groups on utilization at the different levels—State, district, block.

#### *System of Inspection:*

25. Are the irrigation sources, periodically inspected and checked ? If so, by whom ? Give details of the system, periodicity and quality of checking separately for different sources.

26. System and state of irrigation records at the district and block level—(Revenue & Irrigation officials should be contacted in addition to the Block authorities).

(a) Are the targets or irrigation potential figures given in the records of the scheme in terms of gross area or net ? General impression is major and medium works figures are in terms of 'gross area' while for the minor in terms of the 'net area'.

(b) Whether separate figures for areas newly brought under irrigation and areas already receiving some precarious irrigation supplies for which the irrigation facilities are stabilized, are available ? If not, how is allowance made for the areas which had been having precarious irrigation supplies before but have got now stabilized irrigation facilities ?

(c) Is it true that full allowance is not made in reporting figures of area irrigated for those minor irrigation works which have gone out of use ? Comment in detail.



**PROGRAMME EVALUATION ORGANISATION  
(PLANNING COMMISSION)**

*Additional Guide Points for State Note on Irrigation*

1. Definition of major, medium and minor works of irrigation as applied in the State.

**MAJOR IRRIGATION**

2. How far the State Government gives priority in allotment of development blocks to areas served by major irrigation projects? Is the entire area of the project, under study, covered by blocks? If it has still some areas within its command not covered by blocks, the following data may be collected:

Name of the project	Command area		Total No. of blocks served by the project	No. of blocks still to be opened & approximate date when they will be opened
	In the block	Outside		
(1)	(2)	(3)	(4)	(5)

3. Definition of area of irrigation potential at the channel outlets. How is it calculated? Discuss in detail the points mentioned in 3 (f) and 4 (a) & (b) of the Guide Points for Block/State Note on Irrigation.

4. Obtain from the Chief Engineer, the following data for the major project selected by us for study for the last five years. Comment on the two measures of utilization of irrigation facility, the ratio of col. 3 upon col. 2 and of col. 5 upon col. 4.

Year	Irrigation potential (area)	Area irrigated	Volume of water made available	Volume of water utilized
(1)	(2)	(3)	(4)	(5)

5. Action taken by the State Government on the Planning Commission's suggestion for fuller utilization of irrigation potential: The Planning Commission had advised all the State Governments on the following specific points to expedite further the utilization of irrigation potentials:

(a) Are the obligations of the beneficiaries clearly defined by law? What is the stage of legislation? And, if the obligations are laid down by law, how far are they enforced?

(b) It was suggested by the Planning Commission that the alignment should be marked out by the project authorities on village maps and these maps should be supplied to the district and Block authorities in good time.

(c) It should be the responsibility of the district and Block Development authorities to ensure the excavation of field channels in consultation with the project authorities so as to synchronise with the construction of distributaries and minors in the project areas. District Development Committees and Block Advisory Committees and Panchayat Samities should review the progress made in carrying out the programme from time to time and take steps to remove difficulties and bottlenecks. It should be ensured that at the same time as the canal system is ready, the excavation of field channels by the beneficiaries is completed. Village institutions should be empowered to carry out the works and recover costs from the beneficiaries in case of default.

(d) One particular department should be made responsible for preparing complete information regarding the programme and progress of utilization, and that the Collector or the Deputy Commissioner in each district should be the co-ordinating authority for all the activities of the concerned departments in this respect.

(e) For the Third Five Year Plan, the plans drawn up by State Agriculture Departments should include a suitable lump sum provision specifically for 'demonstration farms and other agricultural developments in areas to be irrigated by new projects'. Other concerned departments should embody adequate provision for carrying out developmental activities in the areas to be irrigated by new projects.

(f) It was suggested in separate letters addressed to each State, excepting Assam and Jammu & Kashmir, that where water rates are not compulsory, a compulsory water cess should be levied on the entire area for which irrigation facilities are provided.

#### MINOR IRRIGATION

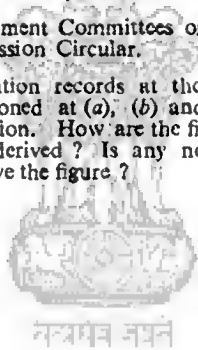
6. Has the State selected any area for pilot projects for works programme for utilizing rural manpower? If so, give details about the schemes prepared, whether they include schemes for minor irrigation, solution of water-logging, drainage, reclamation of saline lands, etc. How are works taken up whether through contractors and without co-ordination with the Block organisation or with their close cooperation? Are Panchayat Samities and village panchayats associated in the works programme? If so, how? Are there any labour cooperatives? Whether in the case of works to be undertaken by villagers, wages are paid at below local wage rates in appropriate seasons?

7. How far have the problems in the State, if any, arising from land reforms affected the administrative arrangement and maintenance of minor irrigation works? Give the details as indicated in question 12 of the Block/State Note.

8. *Problems of Co-ordination*: Discuss in detail the organisational set up at the State, division and district levels, its functioning and the attempts made to achieve co-ordination between Irrigation, Agriculture and Revenue Departments in respect of minor irrigation works. Suggest, if you can, directions in which improvements can be made.

9. *Functioning of Development Committees or Working Groups* on utilization as laid down in Planning Commission Circular.

10. *Records*: State of irrigation records at the level of the major project especially in respect of the points mentioned at (a), (b) and (c) of para 26 of the Guide Points for Block/State Note on Irrigation. How are the figures of area benefited or served by new minor irrigation works derived? Is any norm of per acre cost applied to the total cost of the works to derive the figure?



### 1. Particulars of Village Population and Land.

1-1. State..... 1-2. District..... 1-3. Block..... 1-4. Block code.....  
1-5. Village..... 1-6. Village code..... 1-7. Investigator..... 1-8. P.E.O.....  
1-9. Date of Investigation.....

No. of households		1960 (Household list)		Area (0·00 acres)	
1·10. Total		1951	Latest year available	1955-56	1959-60
1·11. Mainly owner cultivators					
1·12. Mainly tenant cultivators					
1·13. Agricultural labourers					
1·14. Artisans					
1·15. Others					
1·16. Total	Population				
1·17. Cultivators of land wholly or mainly owned					
1·18. Cultivators of land wholly or mainly unowned					
1·19. Cultivating labourers					
1·20. Non-cultivating owners of land and other agricultural rent receivers					
1·21. Production other than cultivation					
1·22. Others					

•upto 1955-56 and 1959-60

1.33. Area irrigated by sources (0.00 acres):

Year	Canal (1)	Tube-well (2)	Wells		Tanks (5)	Others		Net area irrigated by all sources (8)
			Masonry (3)	Kutcha (4)		Specify (6)	Area (7)	
1955—56								
1956—57								
1957—58								
1958—59								
1959—60								

## 2. Irrigation, Cropping Pattern and Crop Rotation:

### 2-1. Extent of irrigation by crop and variety (0-00 acres) :

Crop	Variety	No. of times it is usually irrigated in the village		Cultivated in														
				1959-60			1958-59			1957-58			1956-57			1955-56		
		Total	Irrigated	Un-irrigated	Total	Irrigated	Un-irrigated	Total	Irrigated	Un-irrigated	Total	Irrigated	Un-irrigated	Total	Irrigated	Un-irrigated		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)

### 2-2. New crops introduced in the area during the last five years and area under them in 1959-60 (0-00 acres) :

Item	New Crops				
	(1)	(2)	(3)	(4)	(5)
Area (Total)					
Area irrigated					

### 2-3. What significant changes, if any, have occurred in crop pattern in the village in the last five years? Explain their nature (single to multiple crops; inferior to superior strain/crops; long period to short period crops; food to non-food, vegetable or fruit crops).

2.4. Special concessions (like free and/or subsidized supply at the door; concessional and free supply of water; special loans) given within the last five years to encourage growing of particular crops irrigated or un-irrigated :

Crop	Details of concessions given	Agency	Since when	Period for which given	Terms & Conditions		No. of persons receiving concessions		Any special directive in programme operation for concentrating on weaker sections	Remarks
					General	Special for small farmers and tenants	Total	Small farmers and tenants		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)



2.5. Significant crop rotations followed in the village for irrigated areas. (Mention also the crop rotations which cover more than one year) :

*Crop Rotations (C.R.)	Period of rotation	Proportion of cultivated area under the C.R.	
		At present	5 years before
(1)	(2)	(3)	(4)

\*Record the crops sown in successive time sequence in one row.

2-6. Significant crop rotations followed in the village for unirrigated areas. (Mention the crop rotations which cover more than one year):

*Crop Rotations (C.R.)	Period of rotation	Proportion of cultivated area under the C.R.	
		At present	5 years before
(1)	(2)	(3)	(4)

\*Record the crops sown in successive time sequence in one row.

### 3. Irrigation Facilities in the Village, Their Capacity and Utilization:

3-1. Irrigation works (other than masonry and kutchá wells) existing in the village on the date of visit:

SL No.	Works	Type of ownership (Codes*)	Nature (Perennial-1, Kharif only-2, Rabi only-3)	Whether completed (Yes-1, No-2)	If yes, date of completion; if no, date of start	Date on which water first available	Whether in use	If not, why?	Area commanded (0-00 acres)	Irrigable area (0-00 acres)	Why so much of disparity in cols. 10, 11
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)

\*Government —1; Cooperative—2; Panchayat—3; Private-joint ownership—4; Private individual ownership —5.

†Blocks 3-1, 3-2 & 3-3 of this schedule were also canvassed at the household level.

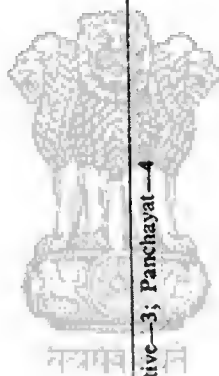
(Continued)

SL No.	Works	Area actually irrigated (0.00 acres)										Total cost of construction (Rs.)	Whether financial assistance from Govt. received in				State of maintenance	
		Last year				1955-56							construction	maintenance	Yes/No	If yes, when		
		Total	If under-utilized, why?	In the village		Total	In the village		Yes/No	If yes, when								
				Kharif	Rabi		Kharif	Rabi										
											Kharif						Rabi	Kharif
(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)		(24)	(25)	(26)	(27)			



3-2. Financial assistance in the Block period for construction of the irrigation works (other than masonry and kutchha wells) existing on the date of visit :

Year	Works (Sl. No. from 3-1)	Loans/Grants	Amount (Rs.)	*Agency from which received	When issued
(1)	(2)	(3)	(4)	(5)	(6)



\*Project—1; Other Govt. department—2; cooperative—3; Panchayat—4

3-3. Financial assistance in the Block period for maintenance of irrigation works (other than masonry and kutchha wells) existing on the date of visit :

Year	Works (Sl. No. from 3-1)	Loans/Grants	Amount (Rs.)	†Agency from which received	When issued	Nature of work done	Total expenditure on maintenance (Rs.)	Any specific problem or difficulty in maintenance
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

†Project—1; Other Govt. department—2; Cooperative—3; Panchayat—4



3-5. For the wells where no financial assistance was given by department or project in construction, record the following details:

Type	No.		No. completed, but water not available now	No. completed	Average life-time (years)	Area actually irrigated (0-00 acres)		Area irrigable (0-00 acres)	No. in 1955-56
	under construction	(2)	(3)	(4)	(5)	Kharif	Rabi		
(1)						(6)	(7)	(8)	(9)

Kutchha

Pucca

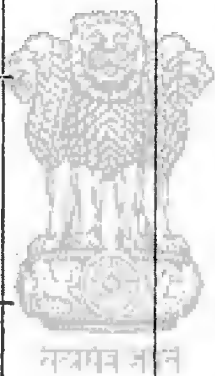
3-6. For the wells where financial assistance was given in the Block period by Government for construction, record the following details works-wise on their capacity and utilization:

Works	Type of ownership (Codes*)	Nature : Perennial—1 Kharif only—2, Rabi only—3	Whether completed Yes—1, No—2	If yes, date of completion, if no, date of start	Date on which water first available	Whether in use	If not, why not	Area commended (0-00 acres)	Irrigable area (0-00 acres)	Area actually irrigated (0-00 acres)		
										Latest year	1955-56	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	Kharif	Rabi	(11) (12) (13) (14)

\*Government—1; Cooperative—2; Panchayat—3; Private-joint ownership—4; Private-individual ownership—5.

3.7. For the wells where financial assistance was given by Government in the Block period for construction, record the following details works-wise on financial assistance in construction:

Works	Total cost of construction (Rs.)	When assistance given	Loans/Grants	Amount (Rs.)	Source of assistance	Cost of construction of similar work anew at present (Rs.)
(1)	(2)	(3)	(4)	(5)	(6)	(7)



3.8. For the wells where financial assistance was given by Government for maintenance, record the following details works-wise on financial assistance in maintenance:

Works	Total cost of construction (Rs.)	When assistance given	Loans/ Grants	Amount (Rs.)	Source of assistance	Total annual expenditure on maintenance (Rs.)	Nature of work done	Any special problem or difficulty in maintenance
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

**PROGRAMME EVALUATION ORGANISATION  
(PLANNING COMMISSION)**

*H-1: Household Schedule on Irrigation and Multiple Cropping*

**I. IRRIGATION AND MULTIPLE CROPPING:**

**1. Identification:**

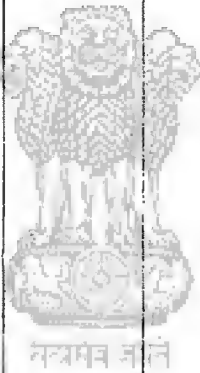
- 1-1. State..... 1-2. District..... 1-3. Block..... 1-4. Block code.....  
 1-5. Village..... 1-6. Village code..... 1-7. Name of the head of household..... 1-8. Household No.....  
 1-9. Category..... 1-10. Cultivated holding in the village (0-00 acres)..... 1-11. Entire cultivated holding including the portion outside the village (0-00 acres)..... 1-12. Investigator..... 1-13. P.E.O..... 1-14. Date of investigation.....

**2-1. Cultivated Holding at the beginning of Kharif (0-00 acres):**

Year	Cultivated holding Irrigated			Unirrigated	Net sown area	Current fallow	Area sown more than once
	Kharif only	Rabi only	Both				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

## 2.2. Cropping Pattern :

Crops grown		Area (0.00 acres)									
		1959-60		1958-59		1957-58		1956-57		1955-56	
		Irrigated	Unirrigated	Irrigated	Unirrigated	Irrigated	Unirrigated	Irrigated	Unirrigated	Irrigated	Unirrigated
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(11)



## 2.3 Crop Rotation.

Record the crops sown in successive time sequence	Period of rotation	Proportion of cultivated area under the crop rotation	
		At present	5 years before
(1)	(2)	(3)	(4)

3-1. His wells existing on the date of visit :

Type	No.		For Completed Works						For wells receiving financial assistance from Government		
	Under construction	Completed, but water not available now	No. completed	Average life-time (years)	Area actually irrigated (0-00 acres)		Area irrigable (0-00 acres)	No. in 1955-56	No. under construction	No. completed, but water not available now	No. completed
					Kharif	Rabi					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Kutcha											
Pucca											

## 3.2. Capacity of wells existing on the date of visit :

Sl. No.	Type (kutchha or pucca)	Type of ownership (codes*)	Nature (Perennial—1, Kharif only—2, Rabi only—3)	Whether completed (Yes—1, No—2)	If yes, date of completion; if no, date of start	Date on which water first available	Weather in use	If not, why?
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

## \*1. Private-joint ownership.

## 2. Private-individual ownership.

## 3. Others (specify).

## 3.2.—(Continued)

Sl. No.	Area commanded (0·00 acres)	Irrigable area (0·00 acres)	Area actually irrigated (0·00 acres)				Total cost of construction (Rs.)	Whether financial assistance received in				State of maintenance	
			Latest year ( )		If under-utilized, why ?	construction		maintenance					
			Kharif	Rabi		Yes/No		If yes, when	Yes/No	If yes, when			
(1)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)



## 3.3. Financial assistance in the Block period for the construction of his wells :

Year	Works (Sl. No. from block 3.2)	Loans/Grants	Amount (Rs.)	*Agency from which received	When issued
(1)	(2)	(3)	(4)	(5)	(6)

## \*Project—1, Other Govt. department.—2, Cooperative—3, Panchayat—4

## 3.4. Financial assistance in the Block period for the maintenance of his wells :

Year	Works (Sl. No. from block 3.2)	Loans/Grants	Amount (Rs.)	†Agency from which received	When issued	Nature of work done	Total expenditure on maintenance (Rs.)	Any specific problem or difficulty faced in maintenance
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

## †Project—1, Other Govt. department—2, Cooperative—3, Panchayat—4

**PROGRAMME EVALUATION ORGANISATION  
(PLANNING COMMISSION)**

*H-II : Household Questionnaire on Irrigation and Multiple Cropping*

Block ..... Head of Household .....  
Village ..... Household No. ....

**1. General Problems :**

1-1. Have you any area which is water-logged?

1-2. Since when is this area water-logged ?

1-3. How did it happen ?

1-4. What measures have already been taken to improve the situation ?

1-5. Are there any facilities for drainage ?

1-6. Any suggestions for improvement ?

1-7. Can the land be utilized for cultivation of any crop ? What crops .



1·8. Have you any area which suffers from alkaline deposits

1·9. Since when ?

1·10. How did it happen ?

1·11. What can be done to improve the situation ?

1·12. Have you any area where water does not reach because of wrong alignment of canals or of roads ?

1·13. What measures have been taken ? Any suggestions for improvement ?

1·14. Where do you get repaired engines, pumps and other irrigation appliances ?

1·15. How far you have to travel for this ?

1·16. Have any plant diseases developed in your fields as a result of new irrigation facility ?

1·17. What measures have been taken ?

1-18. Any suggestions for improvement ?

1-19. Whether some of the minor irrigation works in the village are under-utilized ?  
Yes/No .. .. .

1-20. If yes, specify the type of works .. .. .

1-21. What are the reasons for their under-utilization ? .. .. .

(i) Capacity of the work more than required by the owners for their fields .. .. .

(ii) No demand for water by others owning neighbouring fields (cheaper source available) .. .. .

(iii) Others owning neighbouring fields depend on rain .. .. .

(iv) Irrigation works are located very close to one another .. .. .

(v) Others (specify) .. .. .

1-22. Has the village got electricity ? .. .. .

# WORKS

(1)	(2)	(3)

- 1-23. Since when ? .. .. .
- 1-24. Are there in the village farmers who owned oil engine tube-wells or pump sets before the village got electricity ? .. .. .
- 1-25. Are they thinking of switching over to electric tube-wells or engines ? .. .. .
- 1-26. If so, how ? What are their problems ? .. .. .
- 1-27. If not (in 1-25), why not ? What are the hurdles in the way ? Get their detailed reactions .. .. .
- 1-28. Is there any irrigation practice in this village which involves waste of water resources (as in the Bandhis of M.P. or the practice of allowing water to flow from field to field as in Kerala and M.P.) .. .. .
- 1-29. Why is it followed ? .. .. .
- 1-30. What can be done to avoid waste of water resources ? .. .. .





### 3. Tank Irrigation :

- 3-1. Do you own any irrigation tank either as full-owner or co-sharer in the village ?  
Are there any other cultivators who irrigate their land from this tank ? How many ? Give approximately area irrigated (0-00 acres) :

Total	Yours	Co-sharers	Other cultivators
(1)	(2)	(3)	(4)

- 3-2. What are the arrangements for desilting ? How are other beneficiaries associated ?

- 3-3. Has the capacity of your tanks been substantially reduced because of silting ?  
If the response is 'Yes', record for the tank showing maximum reduction :

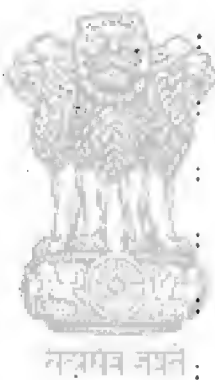
Present capacity of the tank (ac. ft.)	Maximum capacity it had (ac. ft.)	When	Arrangements for desilting		When was it desilted last	Capacity (ac. ft.)		Suggestions for improvement
			Then	Present		Before desilting	After desilting	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

3-4. If the response is 'yes' in 3-3, what would you recommend : desilting the tanks, or raising the tank banks or bunds; why ? .. .. .

3-5. Is there any cultivation in the fore-shore/bed of the tank ? If yes, give reasons.. .. .

3-6. Does it affect tank irrigation adversely ? Suggestions for improvement .. .. .

3-7. Any special comments to offer on weed growth in the beds of the village tanks ?  
Suggestions to check resulting loss of water ? .. .. .



#### 4. Tube-well Irrigation :

4-1. Do you own any private tube-well ? .. .. .

4-2. If yes, give its :  
Capacity ( .. .. . )\*  
Type of power (electric or diesel or bullock)  
Duration of operation in the year .. .. .

4-3. What are servicing arrangements ? .. .. .

4-4. Had you any difficulty because of power shortage ? How did it arise ? Suggestions for improvement .. .. .

\*Indicate unit.



4.5. Have you any comments to offer on system and arrangement of distribution of power? .. .. .

4.6. Any comments on cost of power? Whether the costs are too high, too low or reasonable. Any suggestions for improvement .. .. .

4.7. Are you satisfied with the water rates as charged at present from State tube-wells? .. .. .

4.8. What are the rates? Specify crop-wise (If necessary season-wise also) .. .. .

4.9. How do they compare with irrigation charges/costs from other sources—canals, private tube-wells with oil engines and pump sets. Give separately .. .. .

4.10. Are the rates too high, too low or reasonable? .. .. .

4.11. (In case the respondent says 'it is too high' in 4.10, ask) on what terms and conditions would you consider the present rates acceptable? .. .. .

4.12. (In case the respondent says 'it is too low' in 4.10, ask) would you accept rates higher than those charged at present? .. .. .

4.13. Are you satisfied with the mode of payment of water charges? .. .. .

State	Private

State	Private

4-14. Any specific comments on the distribution arrangements of water ? ..

4-15. Is the water available from tube-wells adequate ? What makes you say so ?..

4-16. Indicate the number of watering given to your crops .. ..

4-17. Have you any comments to offer on the management of tube-wells ? ..

### 5. Problems on Canal Irrigation :

5-1. Indicate your problems in having canal irrigation :

(i) Topography of land .. ..

(ii) Soil conditions .. ..

(iii) Canal irrigation less economical for the crops grown (rainfed crops more profitable) .. ..

(iv) Water inadequate for the crops preferred .. ..

(v) Alternative irrigation works (Tanks, Wells) will go into disuse .. ..

(vi) Lack of financial resources .. ..

(vii) Lack of equipment (like tractors etc.) and facilities for them (saccavi loans) ..

(viii) Use of canal water for other purpose like drinking water .. ..

5-2. (i) Give periods in the years when demand for water is acute .. ..

(ii) Whether water supply inadequate in the month of peak demand ? If so which months ? .. ..

5-3. Is the supply of water regular ? If not, in what months it is irregular .. ..

5-4. Whether distribution of water inequitable (between large farmers and small farmers) ? If yes, give comments .. ..

5-5. Who is the lowest functionary of the Irrigation Department with which you come in contact ? Have you seen any higher officers ? How, many times, and in what period ? .. ..

5-6. Are you aware if there is any rotation register (as 'Thok-wise-Osarabandi' in U.P. or Warabandi in Punjab) which stipulates the order in which fields within a given village are to get water from the outlet .. ..

5-7. Is your name in it ? .. ..

5-8. If not, have you pressed your claim ? .. ..

5-9. Did you deposit the initial fees ? .. ..

5-10. Are you satisfied with the mode of payment of water charges ? .. ..

5-11. (i) Give the rates per acre which you paid for canal water ? .. ..

(ii) Does it vary for different Crops ? .. ..

(iii) Does it take into account number of waterings ( per acre per watering ) ? ..

5-12. What is the value of gross produce per acre (excluding Bhusa) for the crops given in 5-11. .. ..

5-13. Are you satisfied with the water rates as charged at present ? .. ..

- 5-14. Are the rates too high, too low or reasonable ? Give your comments ..
- 5-15. (In case the respondent says 'it is too high' above, ask) on what terms and conditions you would consider the present rates acceptable ? .. ..
- 5-16. (In case the respondent says 'it is low' in 5-14. above, ask) would you accept rates higher than those charged at present ? On what terms and conditions ? If not, why not ? .. ..
- 5-17. Are there any special rates (as Kharaba in Punjab) when crops are damaged like half remission for 'eight annas' crops; full remission for 'four annas' crops or less .. ..
- 5-18. Have you any plots on the tail end of the distributaries ? If 'yes', did you face any specific difficulty *vis-a-vis* those who have their plots on the upper portions ? Give suggestions for improvement .. ..
- 5-19. If 'no', ask : Any specific difficulties faced by cultivators having their plots on the tail portion *vis-a-vis* those who have their plots on the upper portions ? Give suggestions for improvement .. ..
- 5-20. Have culverts been provided over water courses where they cross village roads ? ..
- 5-21. Any suggestions where additional culverts should be located ?.. ..
- 5-22. Any criticism of their present locations ? .. ..

### 6. Field Channels :

6.1. Have you constructed any field channels since the inception of the block ? If yes, give the following details year-wise :—

Year of construction (1)	Length constructed (in yds.) (2)	Irrigated area (0.00 acres)		Total cultivated area (0.00 acres)	
		Before construction (3)	After construction (4)	Before construction (5)	After construction (6)

6.2. What is the source from which water is fed ? .. .. .

6.3. When was water first available at the source ? .. .. .

6.4. When were the corresponding field channels constructed ? .. .. .

6.5. Why this time-lag in the construction of field channels (if relevant) ? .. .. .

6.6. Suggestions for improvement .. .. .

- 6·7. Are you satisfied with the present conditions of the field channels ? .. ..
- 6·8. When was their desilting done last ? .. ..
- 6·9. Are the field channels adequate now ? .. ..
- 6·10. What difficulties did you face in the construction of field channels ? .. ..
- 6·11. Have you any suggestions to make for reorganisation of field channels so as to  
(i) reduce wastage of water (ii) save land without loss of irrigation .. ..
- 6·12. Will you suggest any change in the system of distribution of water ? .. ..
- 6·13. Who is responsible for construction and maintenance of field channels at present ?  
For what length or what block area ? .. ..
- 6·14. What is the part you have been playing as beneficiary ? .. ..
- 6·15. Will you suggest any changes ? Indicate the exact changes. Give reasons for  
your answer .. ..

### 7- Views about Irrigation Extension :

7-1. Are you getting enough water to irrigate as much land as you would like to ?..

7-2. If not, give the following details with measures already taken and suggestions for improvement .. .. .

(i) Crops, if any, which you would have irrigated but could not do so at present

(ii) New crops, if any, which you could have introduced but could not do so at present

7-3. Give reasons for not getting enough water .. .. .

(i) Your plots not within command area .. .. .

(ii) Shortage of water in the works .. .. .

(iii) High water charges .. .. .

(iv) Irregular supply of water .. .. .



(v) Others (specify) .. .. .

7-4. Is the water available at the right time ? Give your suggestions to remove the difficulties ? .. .. .

7-5. Is the water available in adequate quantity ? Give your suggestions to remove difficulties .. .. .

7-6. What are the facilities you want from project authorities to be able to irrigate more land ? .. .. .

7-7. Are you planning to extend the area under irrigation ? .. .. .

7-8. What is the project or work you have in view ? Give its total cost .. .. .

7-9. What is the proportion of the total cost you hope to recover from financial assistance expected from the project ? .. .. .

7-10. What difficulties you envisage in carrying out the project ? .. .. .

7-11. Will consolidation help or hinder further extension of irrigation ? .. .. .

**PROGRAMME EVALUATION ORGANISATION  
(PLANNING COMMISSION)**

*Proforma for collecting Information from State Governments on Minor Irrigation*

**1. Information on Lift Irrigation Works—(Wells—Kutcha, Pucca, Pump sets and Tube-wells etc.):**

Type of works	Average life-time	Average area which can be irrigated	Cost	Standard of adequate return, prescribed for the work (describe; how is it fixed)	Govt. regulations to achieve the standard and check creation of works which do not fulfil the condition in col. 5
(1)	(2)	(3)	(4)	(5)	(6)



**2. Information for Government Tanks Classified by Tank Ayacut Group:**

Tank (ayacut groups)	Average life-time	Cost	Average area which can be irrigated	Average rate of decrease per year in tank ayacut due to silting etc.
(1)	(2)	(3)	(4)	(5)

## 3. Maintenance and Restoration of Tanks (Minor Works) :

Year	No. of tanks restored	Expenditure incurred	Area benefited as a result of restoration	Decrease in ayacut of tanks due to silting etc.	Net position regarding increase in ayacut after deducting entry in col. 5
(1)	(2)	(3)	(4)	(5)	(6)
<b>FIRST FIVE YEAR PLAN</b>					
1951-52					
1952-53					
1953-54					
1954-55					
1955-56					
<b>Total First Plan</b>					
<b>SECOND FIVE YEAR PLAN</b>					
1956-57					
1957-58					
1958-59					
1959-60					
1960-61					
<b>Total Second Plan</b>					

## 4. Budget Provision and Actual Expenditure on Minor Irrigation for the Block Areas in the State :

Year	No. of blocks	Agriculture, minor irrigation and land improvement				Minor irrigation only			
		Budget provision		* Actual expenditure		Budget provision		* Actual expenditure	
		Total	Loans only	Total	Loans only	Total	Loans only	Total	Loans only
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)

1955-56

1956-57

1957-58

1958-59

1959-60

1960-61\*



\*If actual expenditures are not available, approximate estimate of expected expenditures may be given.

## GLOSSARY AND ABBREVIATIONS

Ahars	Kutchra reservoirs of rain water
Ayacut	Command area
Ayacutdars	Owners of the land within the command area of the work
Bandharas	Small canals
Barseem	Green fodder
B.D.C.	Block Development Committee
B.D.O.	Block Development Officer
Boro Paddy	A type of early paddy
Bund	Embankment
Bundhies	Field boundaries
C.C.A.	Culturable Command Area
C.D.	Community Development
Chakbandi	Command area
COPP	Committee on Plan Projects
D.A.O.	District Agricultural Officer
Dhenki or Don	An ordinary bamboo pool arrangement for lift irrigation
D.M.	District Magistrate
D.V.C.	Damodar Valley Corporation
Ex-jagirdari Tanks	Tanks belonging to former jagirdars
Ex-zamin areas	Areas held by former zamindars
Gaon Sabha	Village assembly representing the adult population of the village
Gaon Samaj	Village society
GMF	Grow More Food
Gram Sahayak	Trained village leader
Gules	A local name for water channels
H.P.	Horse Power
Inamdars	Holders of estate or grant recognized by Government and enjoying complete or partial exemption from payment of land revenue
Inamdari Tanks	Tanks belonging to inamdars
Jagirdar	An assignee of land revenue or other rights in an estate or village
Karas	Sub-divisions of a village in Kerala
Kharif	Agricultural season corresponding to summer months
Khesari	A millet
Kuhls	Water channels
Kutchra Well	Temporary well
K.W.	Kilo-watt
Malguzars	An assignee of land revenue in an estate or a village
Mauzas	Villages
M.I.	Minor Irrigation
Moong type I	Pulse
N.A.	Not available
Osarabandi	Turn system
Panchayat	Village council

Panchayati Raj	A system of democratic institutions at the village, block and district levels set up under State legislation
Panchayat Samiti	A statutory representative body at block level
Palewa irrigation	Irrigation done before preparing the fields for cultivation
Patwari	Lowest official of the revenue department
Pattas	Titles of ownership
P.E.O.	Programme Evaluation Organisation
Petty	Irrigation works in Travancore which irrigate less than 5 acres
Pucca Well	A well made of bricks, cement etc.
P.W.D.	Public Works Department
Pynes	Water courses for 'Ahars'
Rabi	Agricultural season corresponding to winter months
Rahat	Persian wheel
Rahat Pumps	Wells fitted with pump sets
Rapat	Sub-surface dams in Rajasthan
Ryots	Cultivators
Sarpanch	Head of the village panchayat
S.D.O.	Sub-Divisional Officer
Shajrah	Village map plan
Shramdan	Voluntary contribution in the form of labour
Taccavi loans	Seasonal agricultural loans
Tehsildar	Revenue Officer at the Tehsil level
T.C.M.	Technical Cooperation Mission (of the U.S.A.)
Thok	Blocks of area
Thokdars	Persons in-charge of "Thoks"
Vikas Samitis	<i>Ad hoc</i> village development committees
Warabandi	Turn system
V.L.Ws.	Village Level Workers
Zamindari	Intermediary rights in land
Zamindari Tanks	Tanks under the former zamindars
Zamindars	Holders of intermediary rights in land
Ziladar	An official of the canal department
Zila Parishad	A statutory representative local body at the district level

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सत्यमेव जयते

## PROGRAMME EVALUATION ORGANISATION

### (PLANNING COMMISSION)

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- 2.\* Evaluation Report on First Year's Working of Community Projects.
- 3.\* Community Projects—First Reactions.
4. Training of Village Leaders in Bhopal.
5. Cotton Extension in PEPSU—A case study.
- 6.\* Evaluation Report on Second Year's Working of Community Projects (Vols. I & II).
- 7.\* Evaluation Report on Second Year's Working of Community Projects (Summary).
8. Training of Village Artisans in Bihar.
9. Leadership and Groups in a South Indian Village.
10. Evaluation Report on Working of Community Projects and N.E.S. Blocks (April, 1956).
11. Evaluation Report on Working of Community Projects and N.E.S. Blocks (April, 1956—Summary).
12. Bench Mark Survey Report—Batala (Punjab).
13. Bench Mark Survey Report—Bhadrak (Orissa).
14. Three Years of Community Projects.
15. Study of Village Artisans.
- 16.\* Bench Mark Survey Report—Kolhapur (Bombay).
17. Bench Mark Survey Report—Morsi (Madhya Pradesh).
18. Studies in Cooperative Farming.
19. Fourth Evaluation Report on Working of Community Projects and N.E.S. Blocks (April 1957)—Vol. I.
20. Fourth Evaluation Report on Working of Community Projects and N.E.S. Blocks (May 1957)—Vol. II.
21. Bench Mark Survey Reports—Malavalli (Mysore) and Chalakudy (Kerala).
22. Bench Mark Survey Reports—Banswada (Andhra), Smalkot (Andhra) and Erode (Madras) Blocks.
23. Bench Mark Survey Reports—Pusa (Bihar), Mohd. Bazar (W. Bengal) and Arunachal (Assam) Blocks.
- 24.\* Bench Mark Survey Reports—Pounta (Himachal Pradesh), Bhadson (Punjab) and Bhathat (Uttar Pradesh) Blocks.
25. Bench Mark Survey Reports—Manavadar (Bombay), Nowgong (Madhya Pradesh) and Rajpur (Madhya Pradesh) Blocks.
26. Fifth Evaluation Report on Working of Community Development & N.E.S. Blocks (May, 1958).
27. Fifth Evaluation Report on Working of Community Development & N.E.S. Blocks—Summary and Conclusions (May, 1958).
28. A Study of Panchayats.
29. Evaluation Report on the Working of the Welfare Extension Projects of the Central Social Welfare Board.
30. Evaluation Report on the Working of the Large and Small Sized Cooperative Societies.

*List of Publications*

31. The Sixth Evaluation Report on Working of Community Development and N.E.S. Block (June, 1959).
32. The Seventh Evaluation Report on C.D. and Some Allied Fields (1960).
33. Evaluation of 1958-59 Rabi Crop Campaign in Punjab, Rajasthan and Uttar Pradesh.
34. Some Successful Panchayats—Case Studies.
35. Some Successful Cooperatives—Case Studies.
36. A Study of the Lok Karya Kshetras of the Bharat Sevak Samaj.
37. Summary of Evaluation Studies (1960-61).
38. Evaluation of the Gram Sahayak Programme.
39. Study of the Multiplication and Distribution Programme for Improved Seed.

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\*Out of Stock.

